ENGINEERING AND MINING JOURNAL

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JULY 1955

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FOUNDED 1866

Marmora Starts Shipping Iron Ore 75

Is Air Flush Drilling Better? 80

How Bunker Hill Blends Charge for Better Lead Smelting 83

Novel Design Permits Selective Magnetic Separation 86

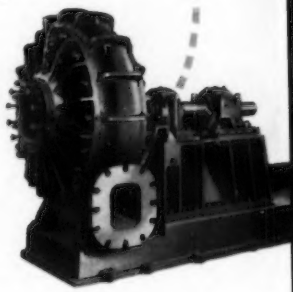
How to Protect Crusher Motors Against Operating Hazards 88

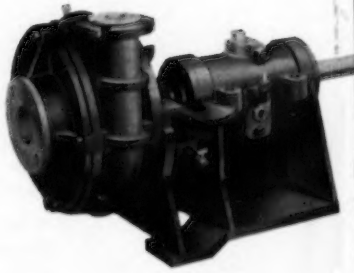
Advantages of Helical Gears 92

Uranium Milling Forum III 96

How the Impact Crusher Cuts Costs . . . 98

For pumping abrasives





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depicts the range of A-S-H pumps available to mining operators throughout the world. This exclusive offering includes 61 different sizes and types of pumps for handling materials from microns to 6" lumps, with capacities from 10 G.P.M. to 12,000 G.P.M. Whatever your need in processing or in tailings disposal, this selection offers you greater pumping efficiency and definite savings in maintenance and power.

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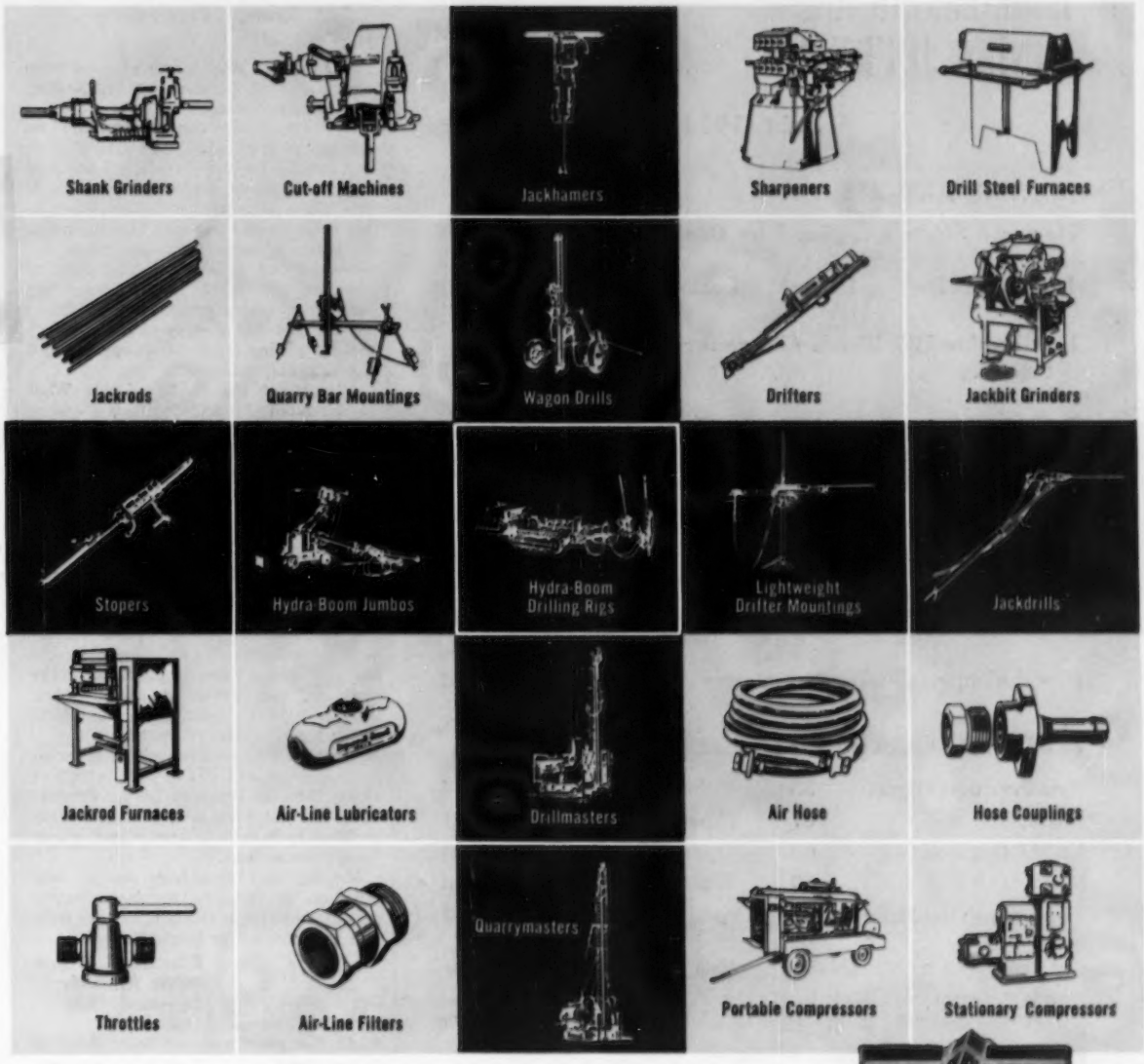

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89th YEAR OF PUBLICATION

VOL. 156 No. 7

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FEATURE ARTICLES

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Advantages of Helical Gears W. P. Schmitter 92

Uranium Milling Forum III 96

How the Impact Crusher Cuts Costs Dr. Edgar Puffe 98

REGULAR DEPARTMENTS

New Products Digest 35

Editorial 67

E&MJ Outlook 68

Markets 69

This Month in Mining 72

Behind the By-Lines .. 74

Personals 101

Operating Ideas 104

Washington Impact .. 108

New Books 114

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LETTERS

Sponge Production

Dear Editor:

We enjoyed reading the very informative article on titanium by Dr. Kellogg in your April issue.

We refer to the "capsule summary" on the last page titled "Who's Doing What in Titanium Production Today." We note that the name of Mallory-Sharon Titanium Corp. is not included in this list, nor is the name of another leading melter of titanium. These two companies account for over half of the production of titanium mill products. On the other hand, most of the companies included in the list are not even producing today, but are getting ready to, or are engaged in preliminary research.

We assume that "Who's Doing What in Titanium Production Today" refers only to companies concerned in converting ore to sponge titanium, and in this sense the title is accurate. Since your magazine is concerned with mining and ore reduction processes, this is undoubtedly what is meant. However, while accurate, this particular statement can be misleading, especially to those not too familiar with titanium.

For instance, the forgers, machine shops and other plants who are actually working with titanium today, would probably consider a titanium producer as the company who produced and supplied them with usable titanium mill products in the form of sheet, strip, bars, etc.

For this reason we suggest clarification by changing the title of this list to "Who's Doing What in Titanium *Sponge* Production," or else include the melters such as Mallory-Sharon Titanium and identifying them as such.

Melting and furnishing usable mill products is certainly an indispensable part of titanium production, and we trust that you will see fit to clarify this.

Edmond C. Powers
Public Relations
Cleveland, Ohio

• *As you point out, we were thinking of converting ore to sponge titanium and not necessarily of production of titanium mill products. We should have made it clearer.—Ed.*

Reprint Reaction

Dear Sir:

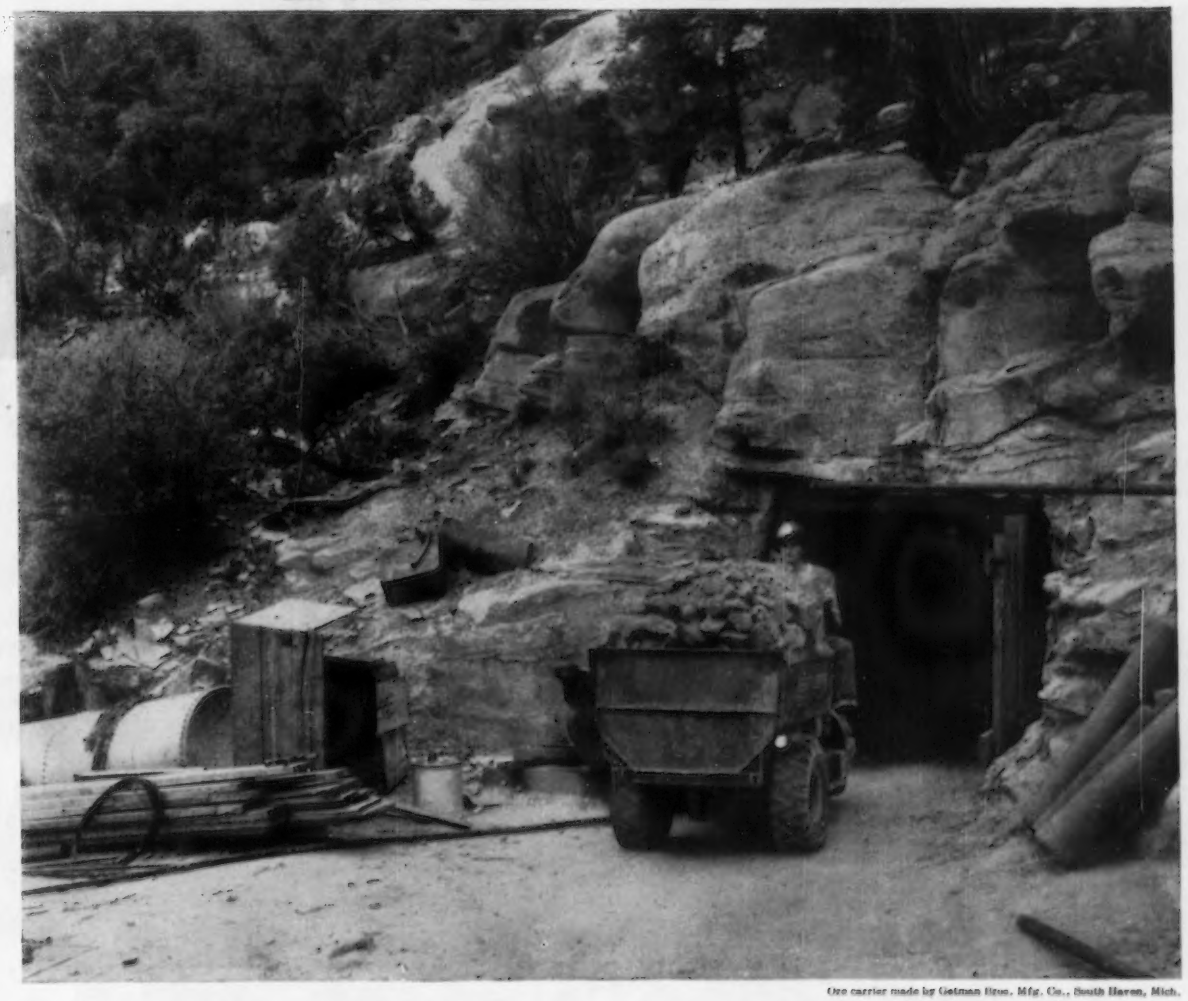
Thank you for forwarding the reprint of "What the Future Holds for Titanium" which appeared in the April 1955 issue of *E&MJ*. To my way of thinking, it is the most practical and complete article appearing on that subject to date.

W. E. McCullough
Chief Metallurgist
Detroit, Michigan

• *To date, over 1300 reprints of the article "What the Future Holds for Titanium" have been requested from this office, and they are still coming in.—Ed.*

(*Continued on p 103*)

RESEARCH KEEPS **B.F.Goodrich** FIRST IN RUBBER



Ore carrier made by Getman Iron. Mfg. Co., South Haven, Mich.

Here comes uranium for the atomic submarine

A typical example of B. F. Goodrich improvement in rubber

OUT of that hole comes the powerful stuff that will make atomic fuel. Climbing up the narrow, twisting tunnels of the uranium mine are trucks so small and compact that there's no room for clutch and gears. Instead they use V belts to run them. But for a while this type of truck wasn't practical because the belts kept breaking. They sometimes lasted only a few days.

All kinds of belts were tried but they couldn't stand the jolting starts and stops, heavy loads, rough driving. Some would snap like pieces of string.

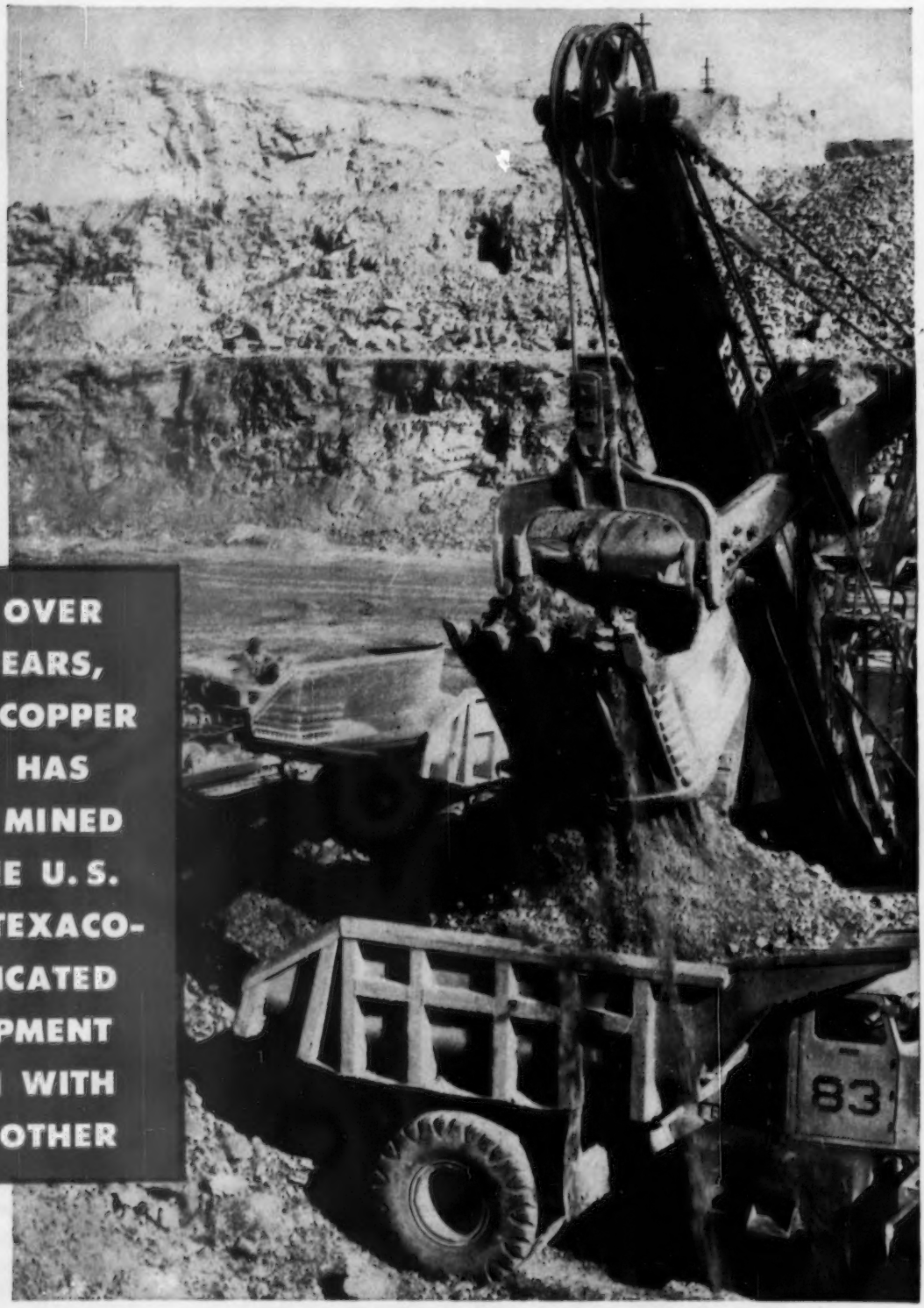
Then the manufacturer heard about Grommet belts invented by B. F. Goodrich engineers. The grommets are two extra strong cord loops inside the belts, like twisted cables except they're endless. High-capacity Grommet belts were put on the trucks. They're so much stronger they last months instead of days.

Product improvement like this is *always* going on at B. F. Goodrich. New ways are constantly being found to make V belts, conveyor belts and hose work better, last longer. No product is ever regarded as "finished" or standardized.

How this cuts your costs: Biggest cost savings come almost always from top performance rather than lowest prices. If you use rubber products, remember B. F. Goodrich is one company that will *never* lower its quality standards. This means you can be sure of top performance and real money savings when you buy from your B. F. Goodrich distributor. *The B. F. Goodrich Company, Dept. M-450, Akron 18, Ohio.*

Grommet—T. M. The B. F. Goodrich Co.

B.F. Goodrich
INDUSTRIAL PRODUCTS DIVISION



FOR OVER 20 YEARS, MORE COPPER ORE HAS BEEN MINED IN THE U. S. WITH TEXACO-LUBRICATED EQUIPMENT THAN WITH ANY OTHER

TUNE IN:
TEXACO STAR THEATER
starring
DONALD O'CONNOR
or JIMMY DURANTE
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Saturday nights, NBC.

TEXACO

TEXACO
REG. T.M.

"Life Insurance" FOR YOUR WIRE ROPE

TO GET maximum protection for your wire rope and keep maintenance costs down, the best "policy" is lubrication with *Texaco Crater*. *Texaco Crater* coats each metal strand with a long-lasting film that guards against wear and rust as it lubricates. And the penetrating action of *Texaco Crater* gets right down to the hemp core—an extra assurance of longer life and preserved strength.

On open gears, *Texaco Crater* provides smoother, quieter operation. It stays on gear teeth without balling up, resists shocks and loads, keeps wear and maintenance expense at a minimum.

If you prefer the convenience of a liquid, use *Texaco Crater X Fluid* for both wire rope and gears. It *goes on* without heating . . . *stays on* like regular *Crater,* with the same outstanding protective qualities.

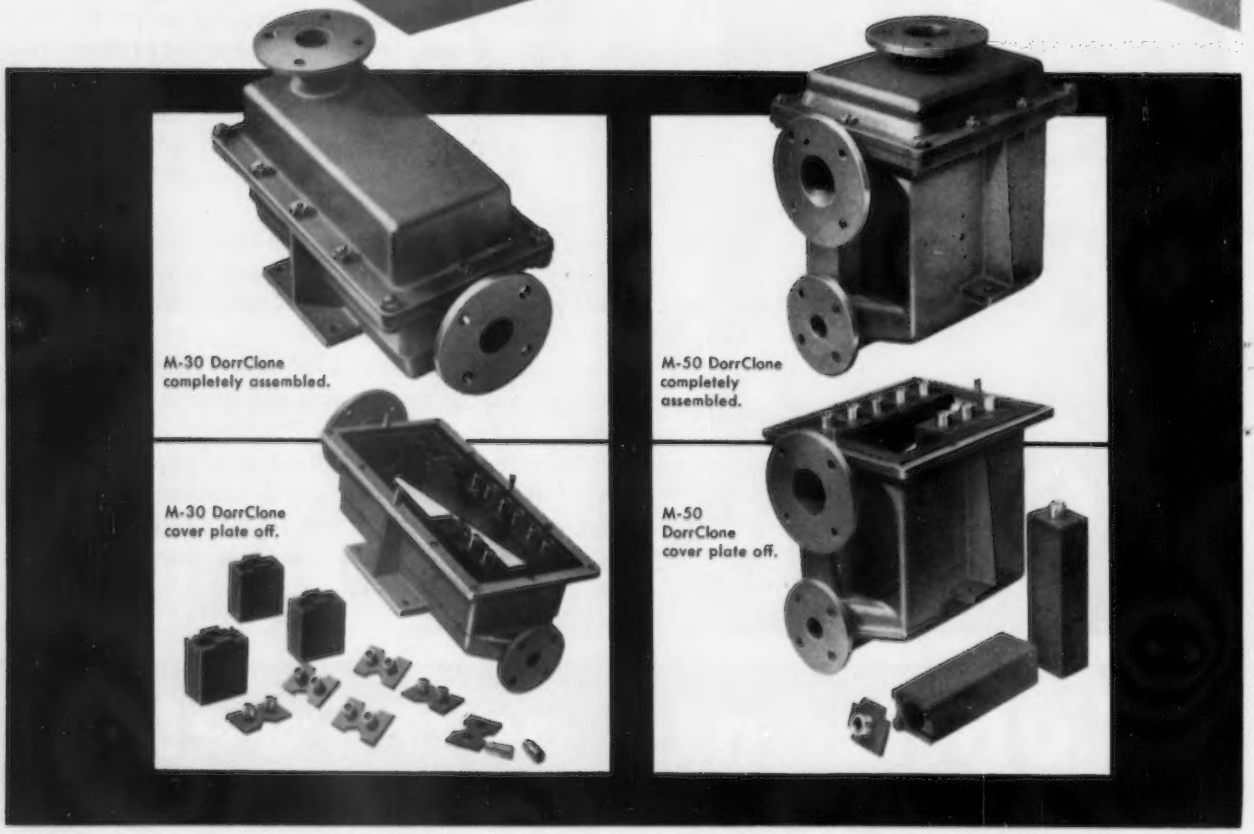
In mine car wheels, *Texaco Olympian Grease* is your best bet for year-round easier starts and effective bearing protection.

A Texaco Lubrication Engineer is at your service with practical lubrication advice you'll welcome. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

Lubricants and Fuels
FOR THE MINING INDUSTRY

New!

THE TYPE M DorrClone

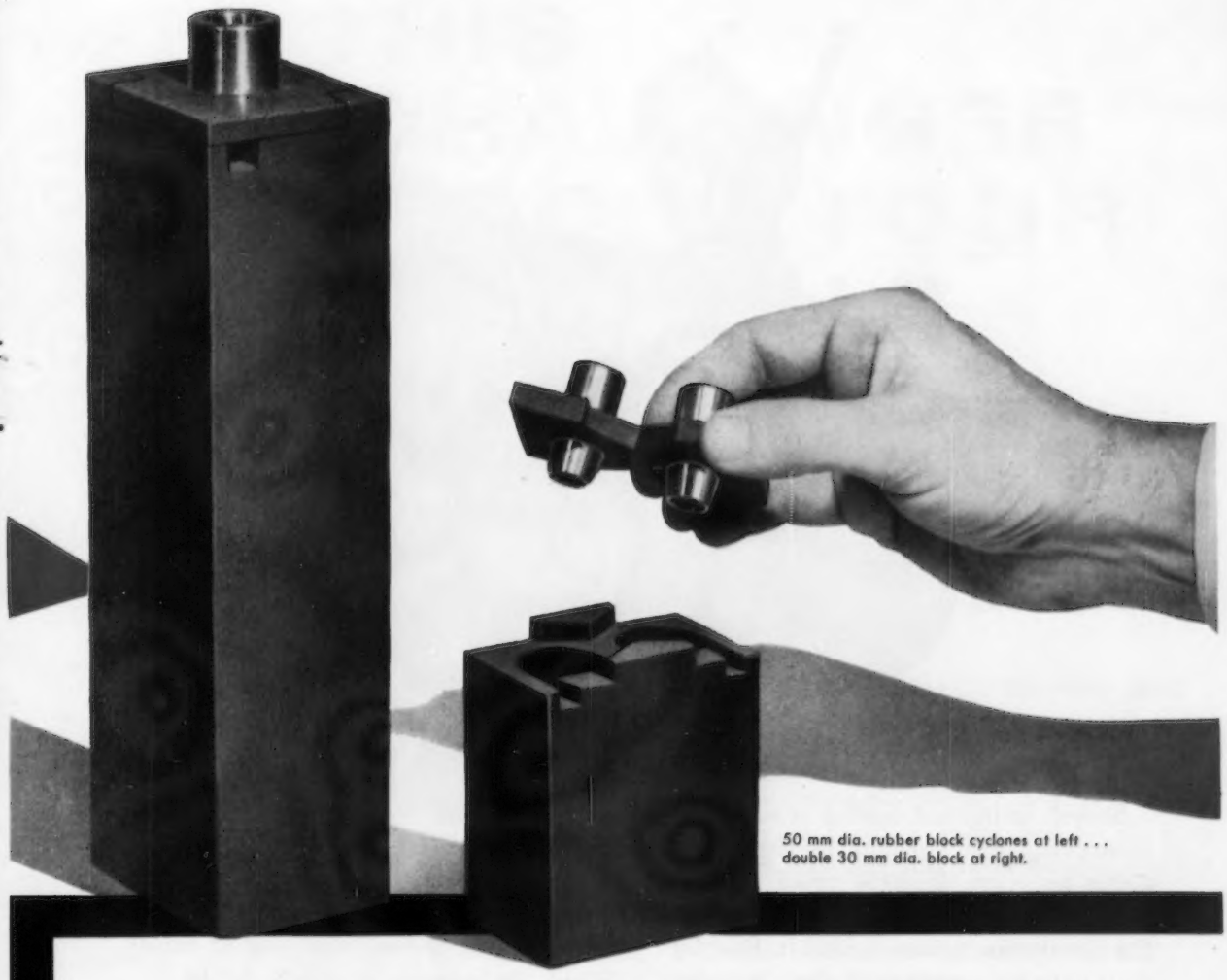


M-30 DorrClone completely assembled.

M-50 DorrClone completely assembled.

M-30 DorrClone cover plate off.

M-50 DorrClone cover plate off.



50 mm dia. rubber block cyclones at left . . . double 30 mm dia. block at right.

Multiple Molded Rubber Block Cyclones Make Sharp Separations in 10-20 Micron Range . . .

Latest advance in wet cyclone design is the Type M DorrClone . . . developed for size separations in the 10 to 20 micron range. Designated as M-30 and M-50, this new design is now available with twenty 30 mm dia. rubber block cyclones or ten 50 mm cyclones in a common housing. Housings may be either cast stainless steel or bronze construction. When cover plate is bolted in place, each block is under compression to form a tight seal between feed, overflow and underflow chambers.

As with all cyclones, capacity and mesh of separation in the M DorrClone varies with the diameter of the individual units, operating pressure, feed solids concentration and specific gravity of the solids. On a slurry with a solids specific gravity of 2.7, the M-30 separates at 8-10 microns and the M-50 at 15-20 microns. As to capacity, the M-30 handles approximately 70 gpm at 20 psi, 100 gpm at 40 psi and 125 gpm at 60 psi. At these pressures the M-50 handles approximately 100 gpm, 140 gpm and 170 gpm. Top operating pressure for both is 125 psi.

For more information on this newest classification tool write for a copy of Bulletin No. 2504. Dorr-Oliver Incorporated, Stamford, Conn.

Lab units also available . . . for test units or very low flows. Fabricate stainless steel housing contains four 30 mm units or two 50 mm units. Separations are the same with equal diameter cyclones. Write for quotation.

DORR-OLIVER
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WORLD-WIDE RESEARCH • ENGINEERING • EQUIPMENT
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TIREX

Shovels biting and tearing at rocky ore — straining and groaning as the dipper comes up — are dramatic proof that all is well with the shovel's trailing cable and the distribution system behind it. Feeding the insatiable appetites of these monster shovels is an undertaking of no mean proportions. It means using cables that are utterly dependable even under the most trying conditions. That is merely another way of saying that all of your shovels should be equipped with TIREX Shovel Cables.

If this shovel and its team of trucks are down even for a few hours, due to cable failure, the increased overhead will be far in excess of the cost of a new cable.

For this reason, we say that price and all other considerations, except operating dependability, are of no substantial consequence. The important point to you is the cost-per-ton of ore mined, not the cost-per-foot of shovel cable.

To keep your cost-per-ton of ore mined down to the lowest possible figure, be sure you equip your shovels with cured-in-lead, Selenium Neoprene Armored TIREX Shovel Cables. They will be on the job long after you've forgotten what they cost.

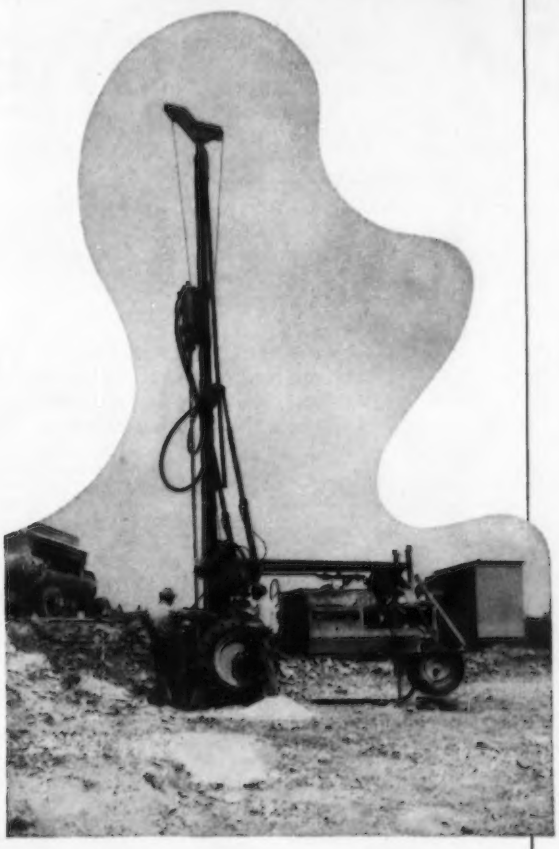
Simplex

TIREX CORDS AND CABLES *are made only by the*

SIMPLEX WIRE & CABLE CO., 79 Sidney St., Cambridge 39, Mass.

THIS JOY CHALLENGER REPLACED FOUR WAGON DRILLS

QUARRY INCREASES PRODUCTION 600 YDS. A DAY IN SWITCH TO JOY TM-500 CHALLENGER DRILL



OVER EIGHT YARDS OF ROCK PER FOOT OF HOLE

. . . That's the production rate of the Joy Challenger on this quarry job. 3½" holes, in a 17' x 13' pattern, were drilled to depths of 30'.

ONLY ONE-AND-A-THIRD YARDS FOR THE WAGON DRILLS

The footage per day with the Challenger averaged 275 ft. The wagon drills . . . with smaller, shallower, less productive holes in a closer pattern . . . averaged only slightly more—300 ft.

CHALLENGER GETS OVER 2200 YARDS A DAY

Compare that with the four wagon drills which were able to produce a bare 1600 yards a day . . . less than 75% of the Challenger's output.

SELF-PROPELLED CHALLENGER SETS UP FAST

The 5¼" TM-500 Challenger Hammer Drill features powerful blowing action and rotation. Hydraulic control of mast and leveling jacks gives fast, easy setups.

BULLETIN 87-U GIVES COMPLETE DETAILS

Write for your free copy, today, to ***Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.*** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

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JOY

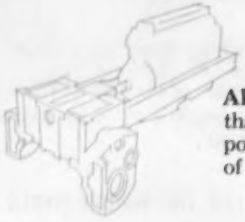
WORLD'S LARGEST MANUFACTURER OF CORE DRILLS AND MOTORIZED DRILL RIGS SINCE 1851

W&D M 5474

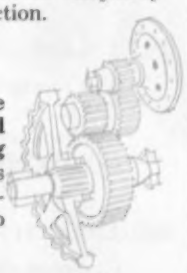
Allis-Chalmers presents the new

ANOTHER BIG STEP AHEAD IN LOW-COST DIRT MOVING

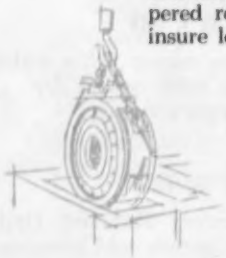
. . . with all the important performance advantages of Allis-Chalmers advanced basic design . . . tested and proved over millions of operating hours!



All-Steel Box-A Main Frame that soaks up shock loads, makes possible the service simplicity of unit construction.



Exclusive One-Piece Steering Clutch and Final Drive Housing with all final drive gears straddle-mounted on tapered roller bearings to insure long life.



Unit Construction lets you remove engine, master clutch, transmission, steering clutches and final drives without disturbing adjacent parts.

1,000-Hour Lubrication Intervals for roller bearing truck wheels, idlers and support rollers . . . makes production time out of service time.

Dual-Range Constant-Mesh Transmission lets you go from any forward speed to any reverse speed by shifting only one lever. Eliminates double shifting! That means faster work cycles . . . more production!

plus . . . these great new features:

New Allis-Chalmers Diesel Engine with "follow-through" combustion and tornado turbulence . . . for smooth engine performance, cleaner combustion, extra long engine life.

New Wrap-Around Radiator Guard used as dozer lift frame to simplify design, reduce cost of bulldozer; guard tilts forward for easy service.

New Master Clutch with Ceramic Lining sets new standards of clutch life . . . with fewer adjustments required.

New Operator Convenience including roomy, flat platform . . . foam rubber seat . . . 24-volt direct electric starting . . . 60-gal. fuel tank.

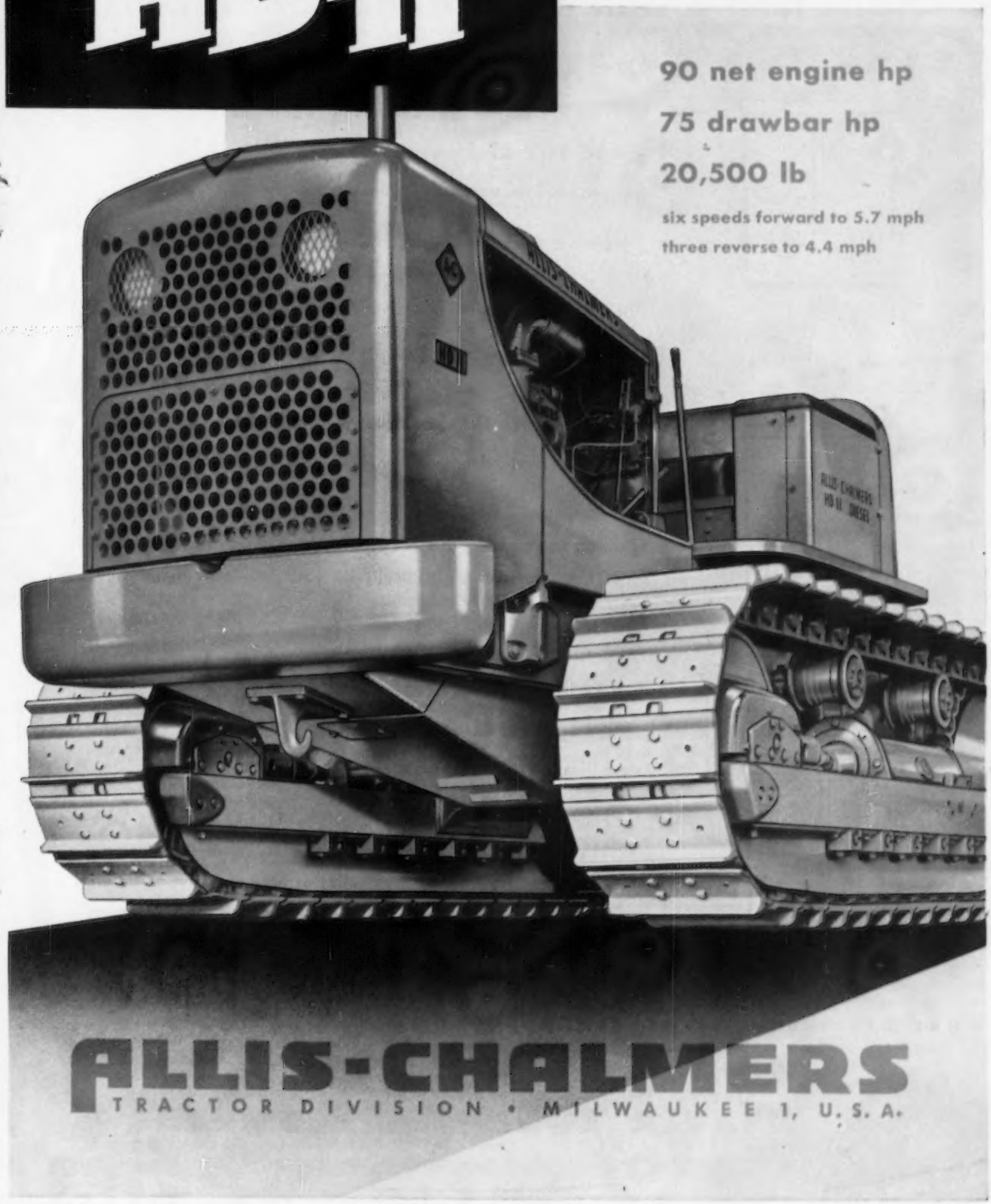
Tough New Track — New design, through-hardened with extra toughness for long life even in severe abrasive conditions.

PLUS . . . new, all-weather cooling; independent radiator-core mounting; new strength and capacity in final drive gears, shafts and bearings.

NEW STANDARDS OF PERFORMANCE AND LONG LIFE ON A WIDE RANGE OF JOBS

You owe it to yourself to investigate the performance advantages of the HD-11 . . . newest addition to the Allis-Chalmers leadership line. See your nearby Allis-Chalmers dealer now.

HD-11



90 net engine hp

75 drawbar hp

20,500 lb

six speeds forward to 5.7 mph

three reverse to 4.4 mph

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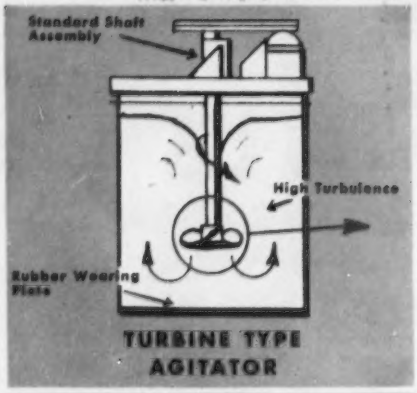
Here are the tools to help you solve your Agitation problems and *Increase Profits!*

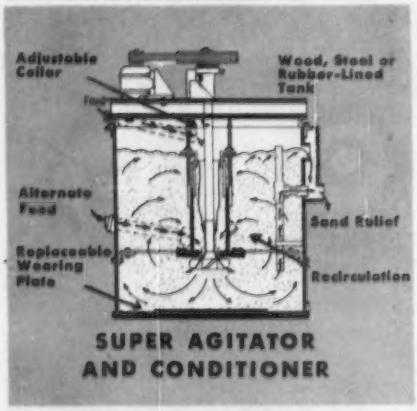


TURBINE TYPE AGITATOR

DENVER Agitators for mixing and leaching

(Copper, uranium, vanadium, lithium, cobalt, zinc)

Denver Agitators and Conditioners are the only machines that are flexible enough to be adapted to meet changing ore conditions. Heavy duty construction gives you dependable service 24 hours a day!

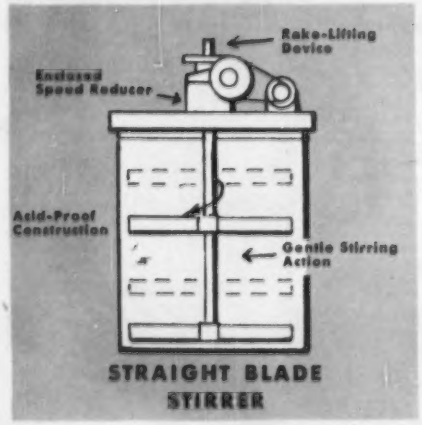


SUPER AGITATOR AND CONDITIONER

DENVER Agitators for flotation

(Barite, phosphate, fluorspar, iron, lead, zinc, copper feldspar)

The patented Denver standpipe gives you a flexible tool to change agitation and aeration to meet your exact requirements. These fool-proof machines will mechanically do your job—low maintenance.



STRAIGHT BLADE STIRRER

DENVER Agitators for precipitation

(Vanadium, lithium, uranium, copper)

This new machine was designed by DECO engineers especially to meet the needs for leaching operations in the Uranium industry—complete suspension of solids without excessive agitation. It is another example of how DECO engineers help their customers solve special jobs!

Our Bulletin A2-B4 describes these Denver Agitators in detail.

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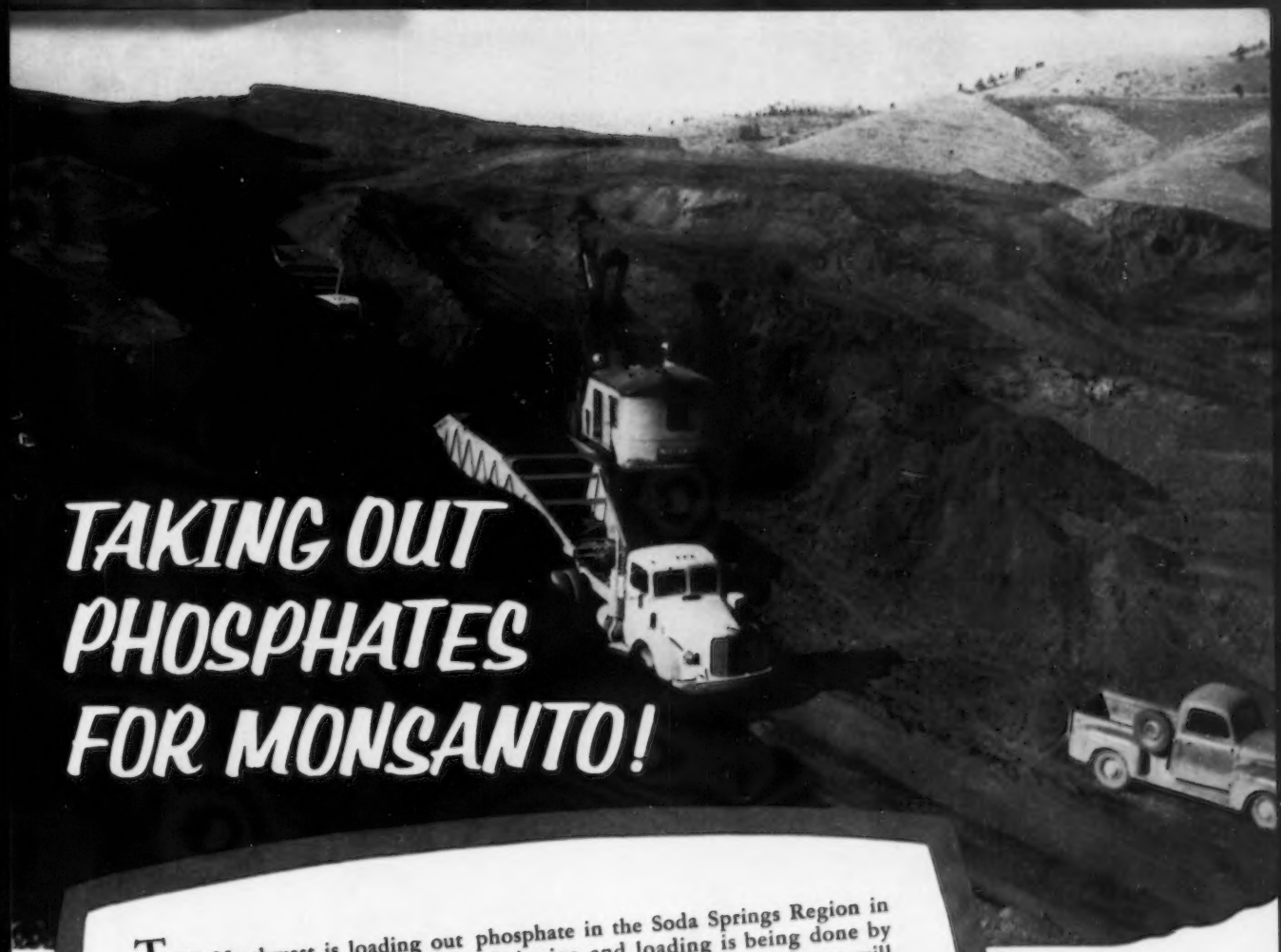


TAKING OUT PHOSPHATES FOR MONSANTO!

THIS Northwest is loading out phosphate in the Soda Springs Region in Idaho for Monsanto Chemical Co. Stripping and loading is being done by the Morrison-Knudsen Co. of Boise, Idaho and the Model 6 Northwest will handle some 350,000 to 400,000 tons before the four month season is out.

Northwests have advantages that make them ideal for mining work. Mine operators will find their unequaled dependability highly profitable, particularly in remote operations. Northwests are always ready to go. You can prove this! Ask Northwest Owners. Northwest steering and self-cleaning crawler action makes the negotiation of mine floors and benches easier. Moving up is no problem. The Northwest Dual Independent Crowd utilizes force most other independent crowd shovels waste. They handle tougher digging and give greater output. Cast Steel Machinery Bases and Side Frames meet the shocks of rock digging and maintain shaft alignment.

It's design that assures reduced wear and repair. The Cushion Clutch reduces overloads on the drum shaft and associated parts by a large percentage and results in reduced frequency of clutch adjustment, in increased cable life and helps to make ample power safe.

These are just a few of the many Northwest features that make Northwests outstanding as a miner's shovel. A Northwest man will be glad to tell you more about it.

NORTHWEST ENGINEERING COMPANY
1509 Field Building, 135 South LaSalle Street, Chicago 3, Illinois

Truck Cranes do a job around the mill and on access road work. Northwest Truck Cranes combine carrier and crane advantages not found in any other similar equipment.

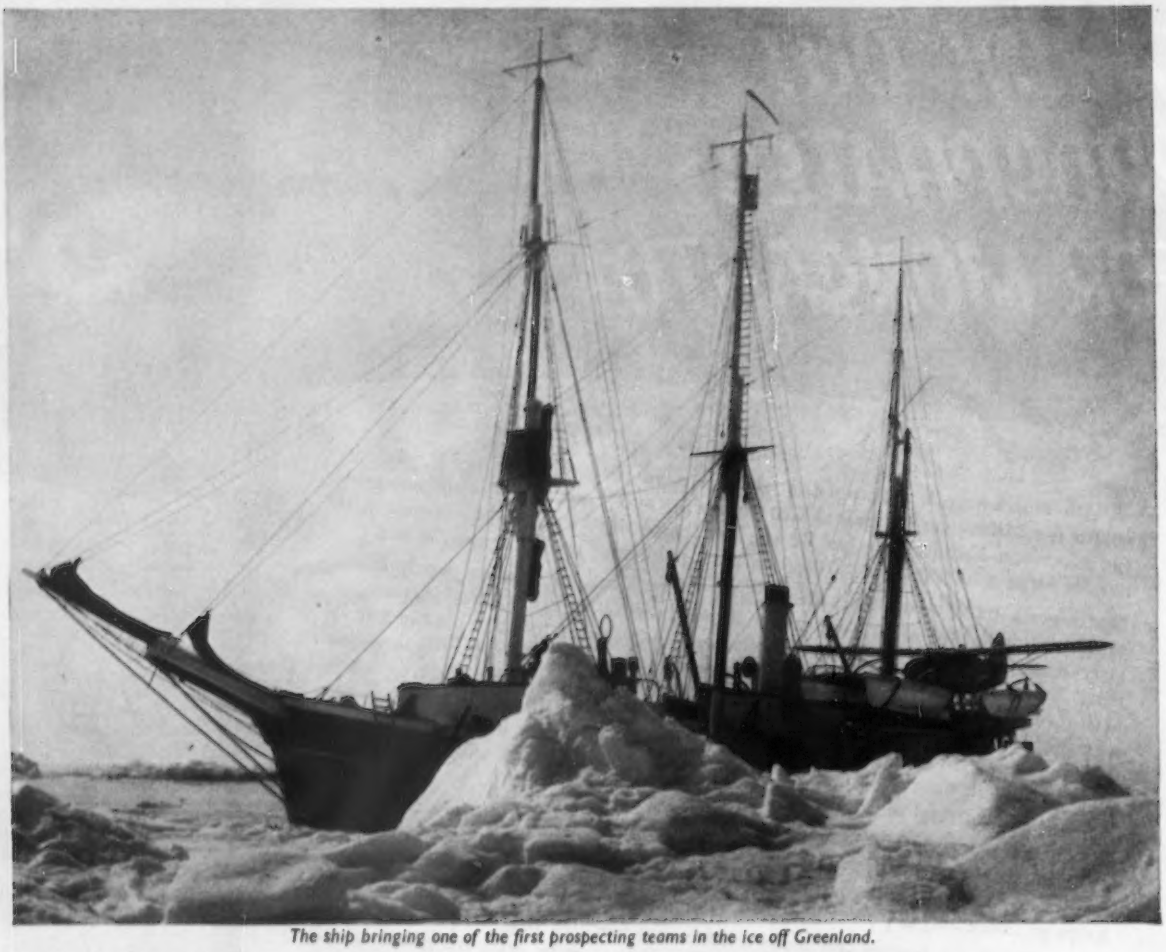
NORTHWEST

Convertible for any Mining Material Handling or Excavation Problem

YOU CAN'T HAVE NORTHWEST ADVANTAGES UNLESS YOU OWN A NORTHWEST

ATLAS COPCO EQUIPMENT SENT TO ARCTIC MINING EXPEDITION

In 1952, an enterprising Danish company, Nordisk Mineselskab A/S, began arduous exploratory work and extensive trial drilling in the mountainous, uninhabited arctic area of East Greenland. They were after supposedly rich deposits of lead and zinc...



The ship bringing one of the first prospecting teams in the ice off Greenland.

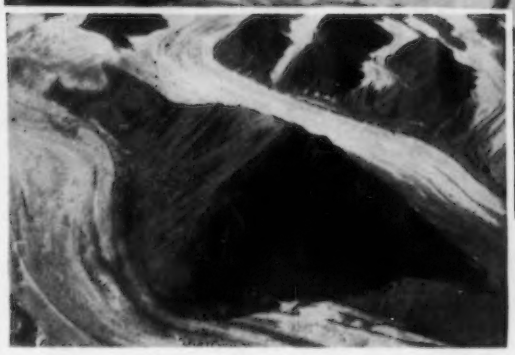
6,500 FEET OF TEST TUNNELS

From the Danish company in the Atlas Copco Group, C. K. Alling A/S, came Atlas Copco rock drills and Sandvik Coromant tungsten-carbide-tipped drill steels to King Oscar's fjord—the site of the mining expedition. Whether these deposits of minerals existed in any worthwhile quantity could now be determined and the equipment was set to work drilling numerous test tunnels—totalling 6,500 feet in length. The results were good. So good, that large-scale mining will start shortly and the first consignments are expected to reach Denmark in about two years time.

MILL INSIDE MOUNTAIN

An unusual feature of this project is the location of the mill for the extraction of the ore. Due to Greenland's arctic temperatures, this will be situated inside the mountain in which mining will take place.

Experts estimate that the mine will yield an annual production of 70-80,000 tons of ore, giving 10,000 tons of lead concentrate and the same quantity of zinc blend concentrate.



An aerial view showing the rough nature of the areas of East Greenland where the mining development is taking place.

Commencing one of the test tunnels with Atlas Copco drills and Sandvik Coromant integral steels. Together they make an unbeatable combination.

DRILLS, STEELS, AND A METHOD

The choice of Atlas Copco rock drills and Coromant drill steels to carry out the drilling tests—and possibly later to work the deposits also—was influenced by the impressive performances they have put up in mines and on construction projects throughout the world.

These drills and steels have been developed closely together to an unbeatable drilling unit. It is a method enabling more drills at the face, smaller crews, faster drilling and economies all round. It is the method that helps beat ever-rising post-war production costs on Kalgoorlie's Golden Mile in Australia. Now, it is opening up a hidden mineral wealth in Greenland.

Supplying air under tough conditions are Atlas Copco stationary and portable compressors and the mucking operations are performed with Atlas Copco loaders.

Atlas Copco Compressed Air Equipment is manufactured or sold and serviced in 48 countries throughout the world by *The Atlas Copco Group*, which embraces companies trading under various names such as Atlas, Atlas Diesel, Atlas Polar, Atlas Copco, Copco, Delfos and Sampa.

MAIL THIS COUPON to the most convenient of the addresses given here:
U.S.A., Copco Pacific, Ltd., 930 Brittan Avenue, San Carlos, California; Copco Eastern, Ltd., P.O. Box 2568, Paterson 2, N.J.; CANADA, **Canadian Copco, Ltd., Montreal, A.M.F., Quebec;** MEXICO, Atlas Copco Mexicana, S.A., Apartado Postal 56, Torreon, Coahuila; PERU, Compania Atlas del Perú, S.A., Apartado 2982, Lima.
UNITED KINGDOM, The Atlas Diesel Co., Ltd., Wembley, Middx.; FRANCE, Atlas Polar S.A., 29, Rue Marbeuf, Paris 8e; HOLLAND, N.V. Holland-Atlas, P.O. Box 6056, Rotterdam; ITALY, S.A.M.P.A.; Viale Marche 15, Milan.
AUSTRALIA, Australian Atlas Company Pty., Limited, P.O. Box 54, Auburn, N.S.W.; SOUTH AFRICA, Delfos Pty. Ltd., P.O. Box 504, Benoni, Transvaal.
Readers in countries outside those listed above and who do not know the name of their local Atlas Copco company or agent, please write, in the first instance, to AB Atlas Diesel, Stockholm 1, Sweden.

Please forward details of ***Atlas Copco Rock Drills and Sandvik Coromant Drill Steels.***

NAME _____

COMPANY _____

ADDRESS _____

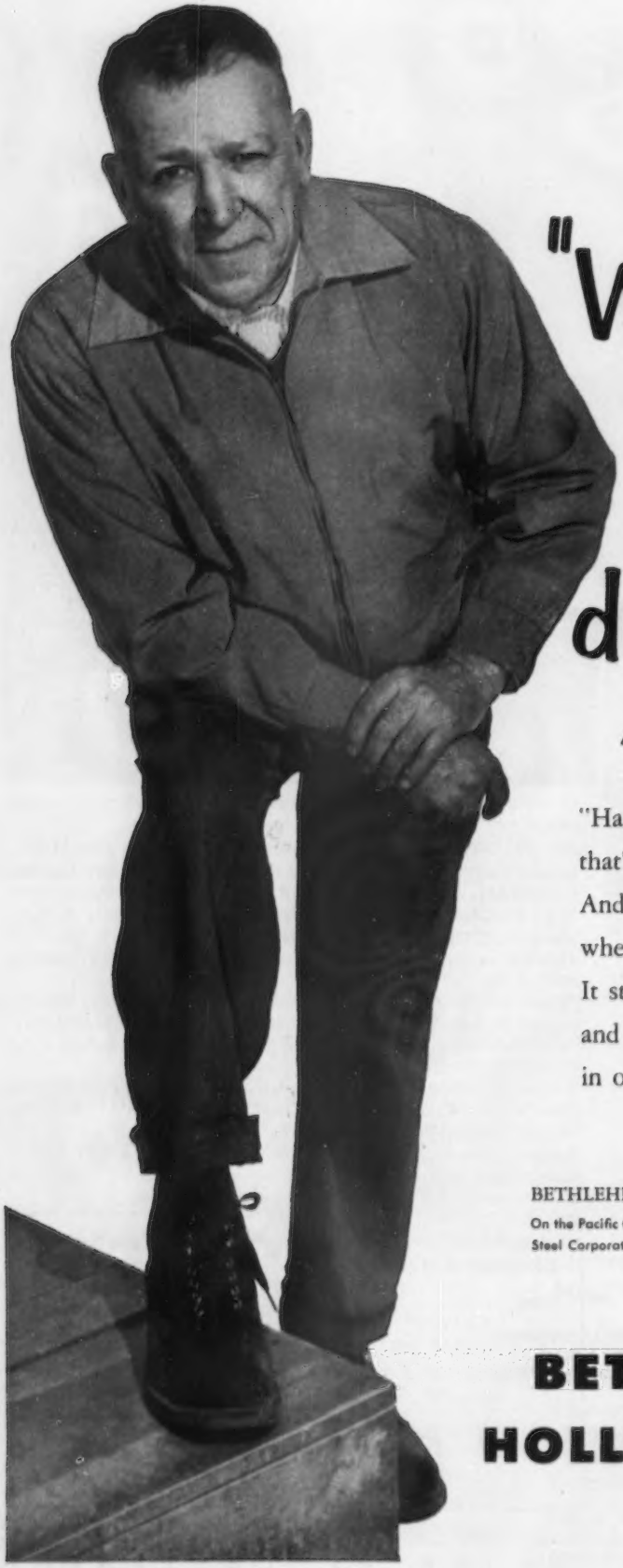
_____

* I am also interested in other Atlas Copco equipment (please state which below).

_____ 5/2

** Manufacturers of Stationary and Portable Compressors, Rock-Drilling Equipment, Loaders, Pneumatic Tools and Paint-Spraying Equipment*

THE ATLAS COPCO GROUP OF COMPANIES



"We like this tough drill steel"

"Hard and tough . . .
that's the way we like drill steel.
And that's the kind we get
when we use Bethlehem Hollow..
It stays on the job a long while,
and saves us a lot of time and money
in our maintenance operations."

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

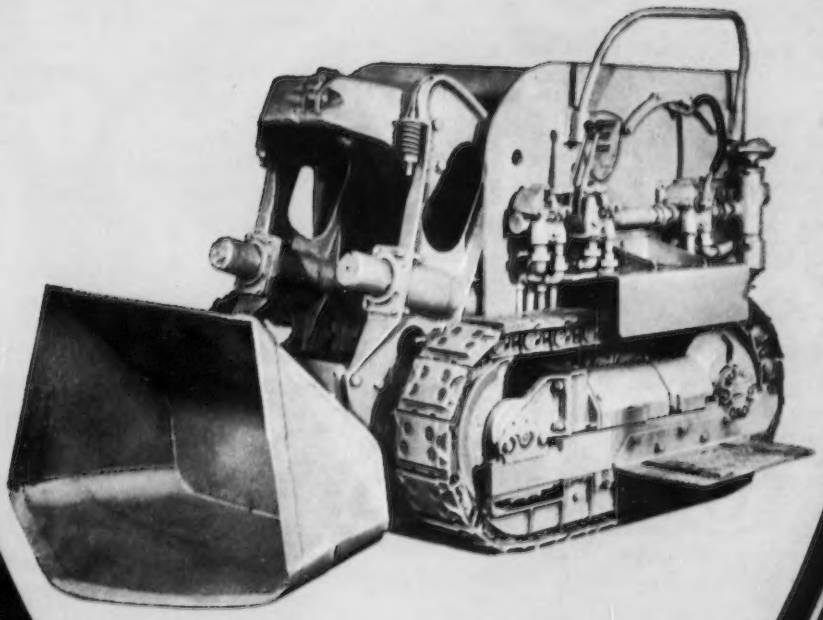
On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM HOLLOW DRILL STEEL

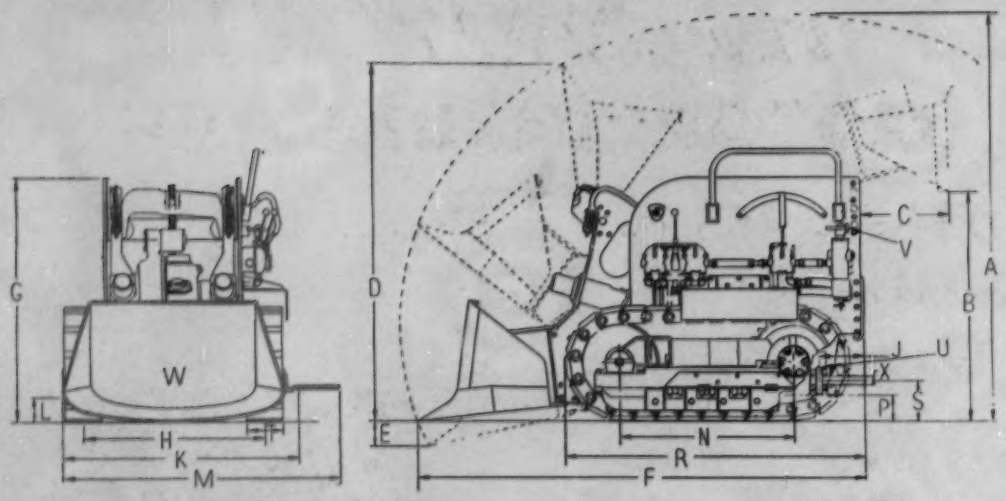
EIMCO'S

answer to "trackless" mining



MODEL 630

EIMCO MODEL 630 SPECIFICATIONS



		FEET	MM
A.	Head Room Std. Bucket	7'10"—9'5½"	2390—2885
	Head Room Nested Bucket	6'8" —8'8"	2030—2640
B.	Discharge Height Std. Bucket	4'4" —6'2"	1320—1880
	Discharge Height Nested Bucket	3'8"—5'10"	1120—1780
C.	Discharge Distance Std. Bucket	19"—22"	480—560
	Discharge Distance Nested Bucket	12"	305
D.	Height at Minimum Length (Std. Bucket)	7'3"	2210
E.	Digging Depth Below Grade	8½"	215
F.	Overall Length (Bucket Down — Std. Bucket)	9'4"	2845
G.	Minimum Height	4'11½"	1510
H.	Track Gauge	45"	1145
J.	Distance from Drawbar to Rear of Machine	11⅛"	285
K.	Minimum Overall Width	4'10½"	1490
L.	Oscillation at Center Line of Front Idler	6"	150
M.	Overall Operating Width	5'8⅝"	1745

		FEET	MM
N.	Length of Track on Ground	43⅞"	1115
P.	Ground Clearance	6"	150
R.	Minimum Length	6'3⅛"	1910
S.	Height of Drawbar Above Ground	9⅝"	245
T.	Track Shoe Width	9"	230
U.	Drawbar Pin	1½" dia.	38
V.	Air Inlet — Pipe Size	1½" IPS	
W.	Bucket Capacity	5½—11 cu. ft.	⅙—⅓ cu. M.
X.	Drawbar Tongue Opening	2"	50
	Weight Complete	9400 lbs.	4260 Kg.
	Area of Ground Contact	790 sq. in.	5,100 sq. cm.
	Speed	0—1.5 m.p.h.	0—2.4 Km/hr.
Y.	Motors (Eimco Air or Electric)	3	3
	Electric Motor Rating	Special	
	Air Motor Rating	12 HP @ 90 p.s.i.	
	Drawbar Pull (lbs.) at Zero Track Slippage	10,600 lbs.	4,800 Kg.

Eimco's 630 series, air or electric powered crawler loader is the answer to a need expressed by miner and contractor alike.

The 630 has many advantages in design for the loader user. Independent track control provides a pivoted turn by running one track forward and the other reverse. This feature makes it possible to attack the muck pile from any angle without backing to make a new run. Improved rocker-arm design provides better action and longer life. All wearing parts are easily replaceable in new patented design. All parts easily accessible. Tracks oscillate for uneven ground. Tracks are equipped with spring release to clear rocks or obstructions in the tracks. Heavy shafts and oversized anti-friction bearings are used throughout. All parts are of heavy alloy-steel cast or fabricated construction for typical Eimco long-life heavy duty operation. Loading capacity 2-3 tons per minute.

Write for complete information.

THE EIMCO CORPORATION

Salt Lake City, Utah—U.S.A. • Export Offices: Eimco Bldg., 52 South St., New York City

New York, N. Y. Chicago, Ill. San Francisco, Calif. El Paso, Tex. Birmingham, Ala. Duluth, Minn. Kellogg, Ida. Baltimore, Md. Pittsburgh, Pa. Seattle, Wash. Pasadena, Calif. Houston, Texas Vancouver, B. C. London, England Gateshead, England Paris, France Milan, Italy Johannesburg, South Africa

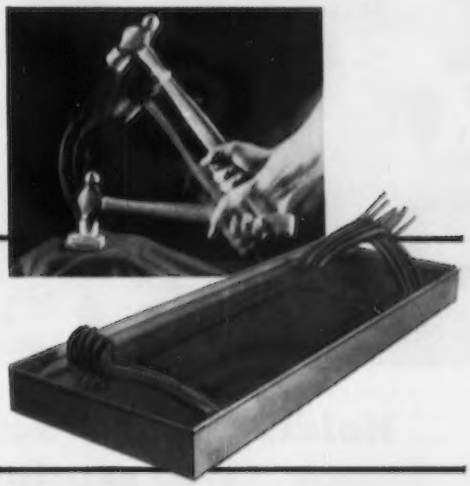
B-115

NEW Silco-Flex MOTOR INSULATION

Offers These Amazing Physical Properties

Allis-Chalmers, working with Dow Corning Corporation, has developed *Silco-Flex* motor and generator insulation . . . truly new in concept . . . truly new in effectiveness.

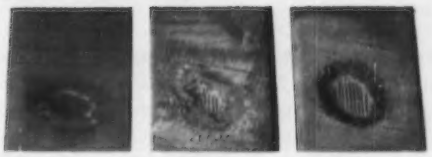
Silco-Flex insulation employs a pure silicone rubber combined with specially developed application techniques to produce an insulation unmatched by any other in use today.



● **Flexibility and Resilience** — *Silco-Flex* insulation remains flexible and resilient indefinitely. It is especially resistant to mechanical abuse and to stresses of overloading, rapid starting and stopping.

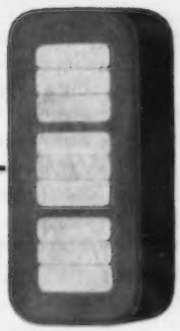
● **Moisture Resistance** — Completely sealed, *Silco-Flex* insulated coils are the most moisture-resistant commercial coils ever produced. They are production-tested while submerged in water . . . by far the most complete and searching high potential test used.

● **Abrasion Resistance** — Samples of insulation at right show effects after sandblasting with 90 grit aluminum oxide and 100 psi air for one minute. Nozzle-to-sample distance was six inches, thickness equivalent to 2300-volt insulation. Note difference in abrasion!



Silco-Flex Insulation | Polyester Mica Tape | Asphaltum Mica Tape

● **Homogeneity** — *Silco-Flex* insulation is a void-free dielectric barrier vulcanized into a unified insulating wall. It maintains its homogeneity under extremes of differential expansion and contraction due to thermal cycling.



Other Advantages include exceptionally good thermal stability and chemical inertness. *Silco-Flex* insulation is also a much better heat conductor than ordinary electrical insulating materials. Moreover, enclosures now required to protect windings from moisture and abrasion may be eliminated in many cases.

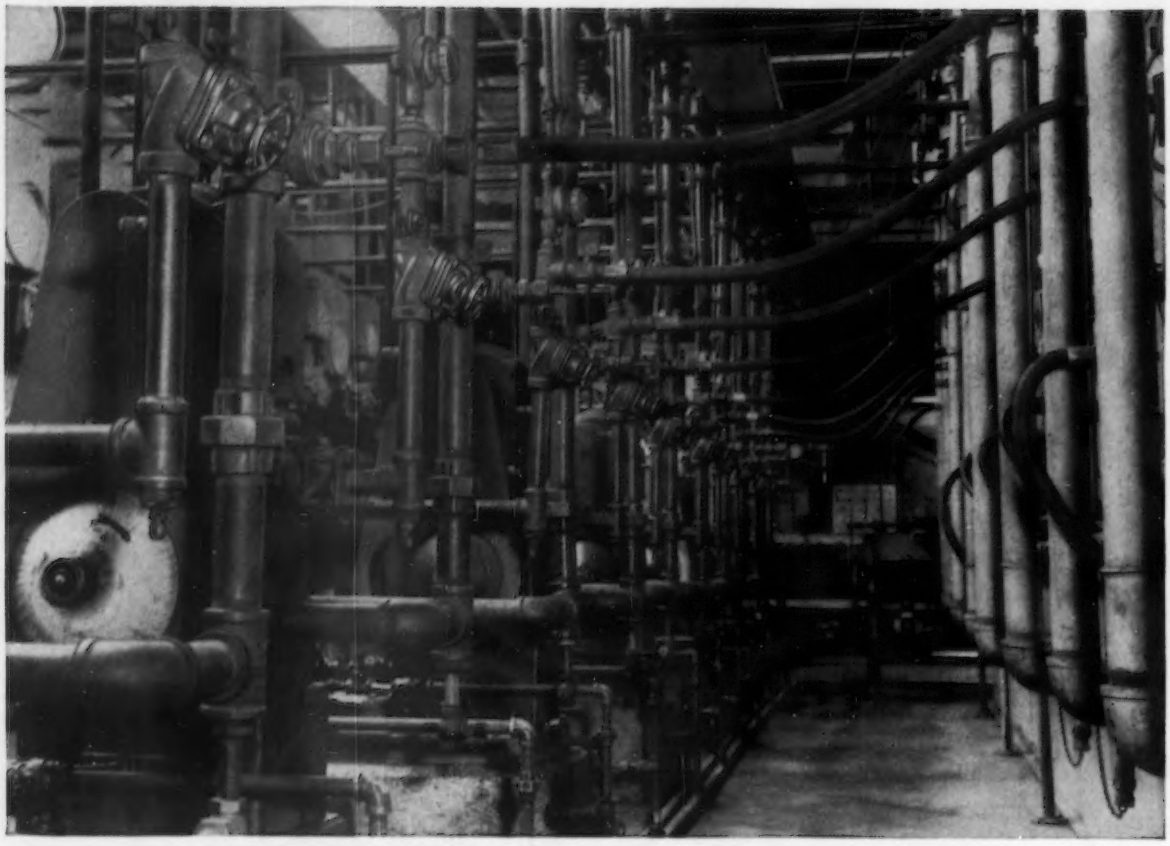
New *Silco-Flex* insulation is immediately available for all Class H form-wound coils and for Class A and B windings operating under selected service conditions. For complete information, call your Allis-Chalmers representative or write Allis-Chalmers, Milwaukee 1, Wisconsin.

A-4774

Silco-Flex is an Allis-Chalmers trademark.

ALLIS-CHALMERS

B-115
Pasadena, Calif. Houston, Texas Vancouver, B. C. London, England Gateshead, England Paris, France Milan, Italy Johannesburg, South Africa



Holding high vacuum with low upkeep is routine for these CRANE VALVES

At the Crosley & Bendix Home Appliance Divs., Avco Mfg. Corp. refrigerator plant at Richmond, Ind., a line vacuum within a few microns of absolute is applied to a dehydration process. But holding this vacuum wasn't always a routine operation.

There was a time when frequent valve failures caused production losses and costly maintenance—stopped only when Crane Packless Diaphragm Valves were installed.

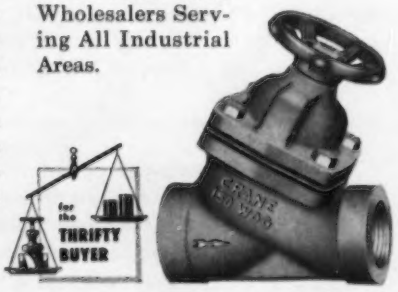
Of the valves formerly used, a multiple metal diaphragm type lasted about 3 months. Crowning of diaphragms caused restriction or closure and made the valves inoperable. Damaged diaphragms meant complete valve replacements.

In other valves, in-leakage at the diaphragm-to-stem connection made them unsatisfactory.

Now in service more than a year, none of the Crane Kel-F Diaphragm Valves has needed any maintenance. Crane simplified construction, giving a longer-life diaphragm... tighter bonnet seal and seating . . . and easier operation . . . is the reason.

The diaphragm in Crane design has longer life because it seals the bonnet only—is not subject to the cutting and crushing encountered when also used for seating. The separate, positive seating disc controls fluid even should diaphragm fail. Wide selection of body materials and trims. Ask your Crane Representative for Circular AD-1942.

Crane Co., General Offices: 836 S. Michigan Ave., Chicago 5, Ill. Branches and Wholesalers Serving All Industrial Areas.

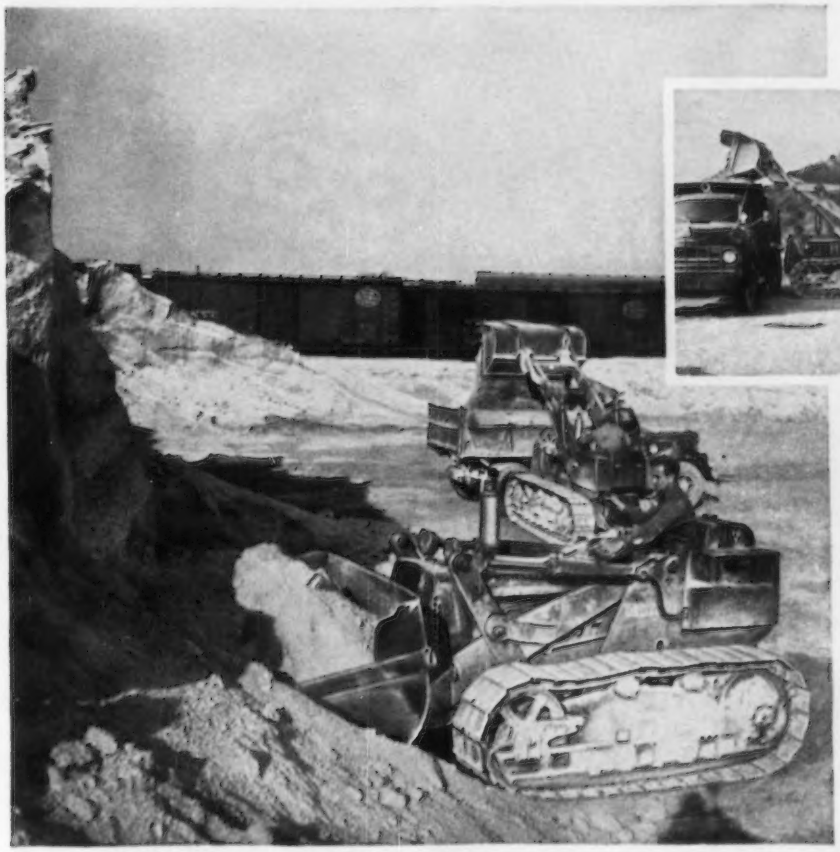


CRANE CO.

VALVES • FITTINGS • PIPE
KITCHENS • PLUMBING • HEATING

CRANE'S FIRST CENTURY...1855-1955

Low Cost Way to Load 185 Tons an Hour



MORE OF THE SAME: *"In 9 months our first TD-9 and Skid-Shovel loaded out over 140,000 tons of road screenings plus farming 300 acres,"* relates N. S. Purtee, partner in the Genoa Construction Company. *"This outstanding and continuous performance clinched the sale of a second loader eight months later."*

LOADING LIMESTONE SCREENINGS is a low-cost materials handling operation for these TD-9s with Skid-Shovels as each unit averages 185 tons an hour, and the two loaded out 40,652 tons one month when one machine only worked two weeks of that period.

Ohioan's invitation to salesmen to "show me something better" than his INTERNATIONAL DROTT TD-9 Skid-Shovels is not accepted.

N. S. Purtee, partner in the Genoa Construction Company of Genoa, Ohio, wants the best front-end loaders available to load out road screenings for a new super highway, so he always tells equipment salesmen: *"Fellow, watch my* INTERNATIONAL DROTT *TD-9 Skid-Shovels work and if you have something better, bring it out."*

His standing invitation has not been accepted for several reasons: INTERNATIONAL DROTT Skid-Shovels—all four sizes—have exclusive Skid-Shoes that utilize the ancient lever principle to develop 300% greater pry-out force than competitive loaders.

This means bigger loads with materials of any density and these heaped loads are retained by a 41° bucket roll-back at ground level feature. Loading force is transferred into the ground by the Skid-Shoes which also enable loads to be semi-skidded at ground level in third rather than first gear.

The Hydro-Spring, a mechanism that absorbs 70% of loader shocks, not only extends equipment life but makes operation of the machine far easier on the operator.

For a short cut to lower cost material handling, call your INTERNATIONAL Industrial Power Distributor. See the highest producing loaders on the market today in action on your job.

INTERNATIONAL HARVESTER COMPANY, CHICAGO 1, ILLINOIS

DROTT MANUFACTURING CORP., MILWAUKEE 8, WISCONSIN

INTERNATIONAL HARVESTER

INTERNATIONAL® DROTT

Wire Rope at Work—Here's a busy Purple Strand haulage rope in the beautifully kept hoist house of an Eastern coal mine. It pulls loaded cars up a 9400-ft slope that has an average grade of 5.5 pct and a maximum grade of 8.7 pct. The design of the installation is based on raising four trips of 45 loaded cars per hour. Stated another way, this means 540 tons of run-o'-mine material per hour.

The rope is a big one—6x21 U, 1¼-in. diam. Wound in four layers on a 12-ft drum, it operates at approximately 1700 ft per min when hauling coal or supplies. Its strength has proved far in excess of actual needs, and its husky wires have shown remarkable resistance to abrasion. Like all Bethlehem mining ropes, it seems to be destined for a long and useful life . . . in a service tougher than most.

Bethlehem Steel Company, Bethlehem, Pa. On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation

Mill depots and distributors from coast to coast stock Bethlehem rope for the following industries and numerous others:
MINING • QUARRYING • CONSTRUCTION • PETROLEUM • EXCAVATING • LOGGING • MANUFACTURING

The USS Forrestal—

another example of how Walworth helps protect a 200 million dollar investment

Keel laying to launching—Walworth was there.

Walworth products installed aboard the *USS Forrestal* include gate, globe, and lubricated plug valves and pipe fittings. They are used on high pressure air lines, fire mains, and most of the other piping systems throughout the ship.

Thousands of Walseal® Bronze Valves, Fittings, Flanges, and Unions comprise the major portion of the Walworth installations.

Walseal is a registered trade mark which identifies valves and fittings manufactured by the Walworth Company. Walseal products have *factory-inserted rings* of silver brazing alloy in threadless ports. Walseal joints can be made only with Walseal valves and fittings.

WALWORTH

valves . . . pipe fittings . . . pipe wrenches

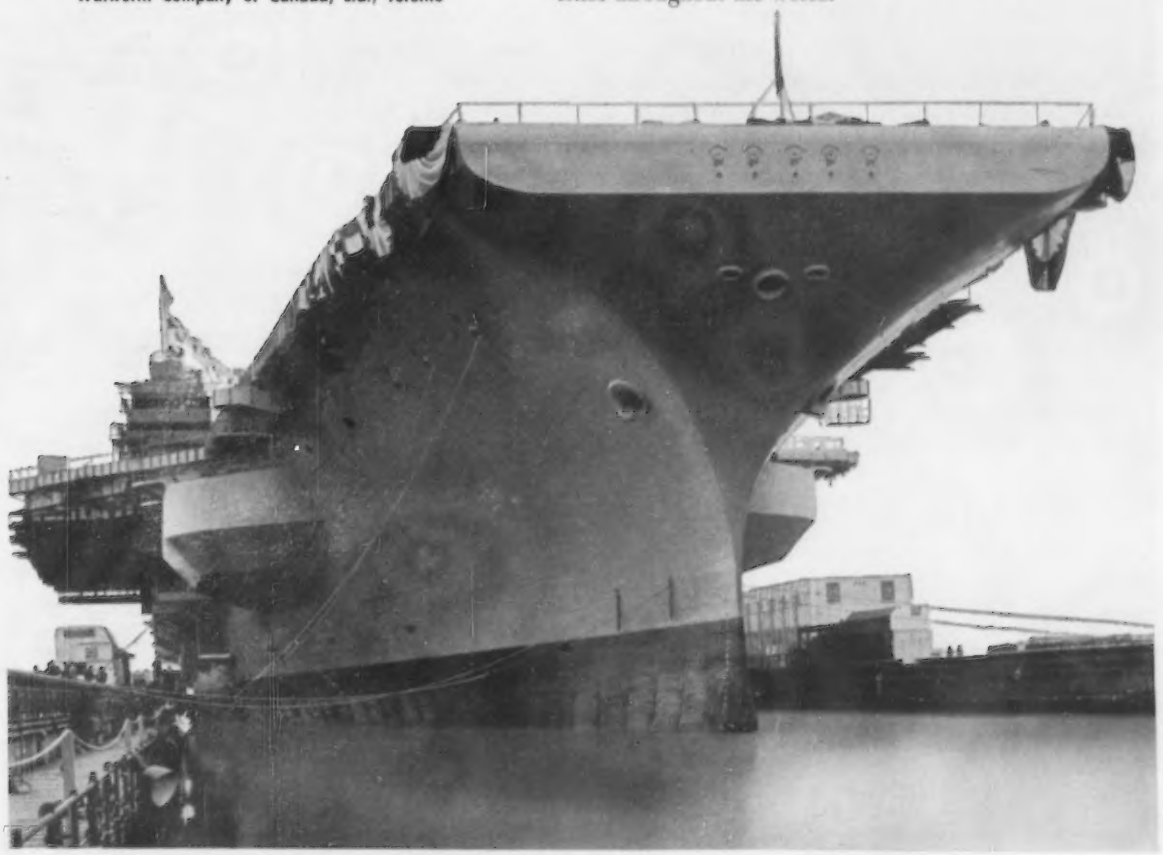
60 East 42nd Street, New York 17, N. Y.

Walworth Company of Canada, Ltd., Toronto

Walworth engineers worked with designers, metallurgists and builders of the mighty flat-top right from the blueprint stage. Their efforts assured the builder – Newport News Shipbuilding and Dry Dock Company – that *every* Walworth Valve and Fitting installed would meet *every* specification right down to the finest detail.

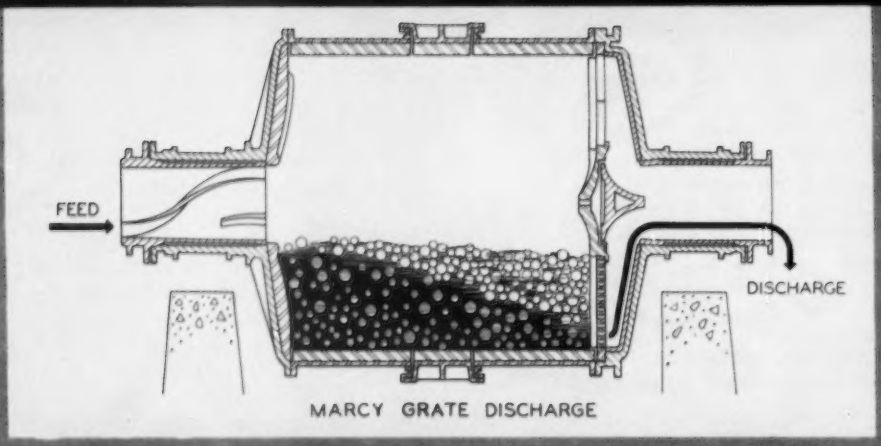
The *Forrestal* – like the *USS Nautilus*, the first nuclear-powered submarine – is another striking example of where Walworth engineering and products were called upon to protect a multimillion dollar investment.

Walworth, backed by 113 years of practical valve experience, is skilled in every type of installation. Whatever the industry, if your problem concerns valves or fittings, it will pay you to call on Walworth! Distributors in principal cities throughout the world.



MARCY Grate Discharge

increases tonnage 25 to 45%
decreases KWH per ton



MARCY GRATE DISCHARGE

"Rapid change of mill content is necessary for high efficiency"... that's the Marcy principle of grinding.

The "rapid change of mill content" is accomplished by use of the Marcy* **full-grate** discharge on ball mills and the **open end** feature on Marcy rod mills. This results in a low pulp line which provides an active, effective grinding mass to act on particle size reduction only... there is no wasteful cushioning action by high pulp levels. There is a faster migration of fines than oversize particles, thus less overgrinding. This basic principle of grinding is incorporated in all Marcy Mills and has proved, in hundreds of installations, to give greater output with lower KWH per ton, from 25 to 45% more tonnage compared with the same size overflow mills.

INCREASE IN TONNAGE WITH MARCY GRATES 124% GREATER THAN WITH OTHER GRATES

In seven representative installations where overflow mills were converted to Marcy Grates the average increase in tonnage was 33.6% with a decrease in power of 0.95 KWH per ton. An installation where an overflow mill was converted to grate discharge using another type grate the increase in tonnage was just 15% with a decrease in power of just 0.08 KWH per ton.

WRITE FOR NEW CATALOG NO. 101A

**Marcy is a registered trademark*

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DENVER 17, COLORADO

OFFICES IN SALT LAKE CITY, EL PASO, 1775 BROADWAY, N. Y. C.

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TOPS IN TEAM WORK – ALL THREE

each does a special job

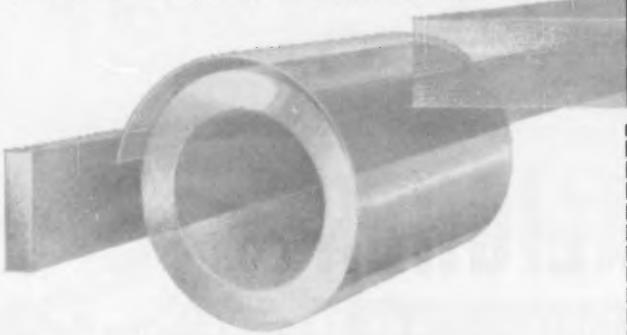
J&L's JALTEN series offers you three top performing high strength, low alloy steels with the following characteristics:

JALTEN NO. 1—High strength, good formability and fabricating—good resistance to low temperature impact.

JALTEN NO. 2—High strength, moderate forming—improved resistance to atmospheric corrosion.

JALTEN NO. 3—High strength—improved abrasion resistance.

J&L STEEL



SEND FOR THIS NEW BOOK:
Chemical properties of Jalten
Mechanical properties of Jalten
Jalten equivalents
Jalten application data

Jones & Laughlin Steel Corporation
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Pittsburgh 30, Pennsylvania

Please send a copy of your Jalten booklet, *JALTEN LOW-ALLOY, HIGH-STRENGTH STEEL.*

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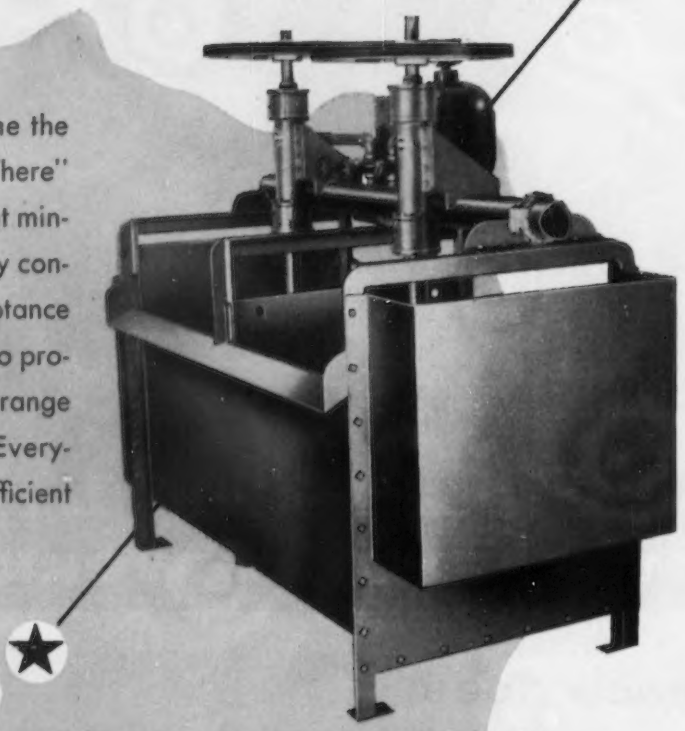
STEEL CORPORATION – *Pittsburgh*

AGITAIR is there

AGITAIR IS THERE has become the metallurgical victory slogan. "There" could mean most any important minerals center , . . located on any continent on earth. Agitair's acceptance is world-wide. Its application to profitable recovery spans the full range of industry's required ores. Everywhere the story is the same—efficient service at lowest cost!



Hitting high score at major vanadium producer in Africa

Africa's main producer of vanadium—for consumption in England and Europe—reports fine success with Agitair Flotation. Air control, simplicity of maintenance and rugged construction keep the mill operation trouble-free and smooth. Agitair is economical, too, in power and reagent consumption.

Experienced Galigher engineers are at your service. All inquiries answered promptly and in detail. What is your recovery problem?

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Use USS Lorain Rolled Plate Linings

to reduce mill "downtime" and cut grinding costs

● One of the biggest robbers of your grinding profits is probably "downtime" for repairs and replacements necessitated by plate failure or bolt breakage. You can lessen costly downtime in your mills by using USS Lorain Rolled Plate Linings. These rugged *rolled steel* plates give extra long service compared to ordinary castings. And they are interchangeable . . . heat treating compensates for localized wear. The special-composition, heat-treated bolts are virtually break-proof and last the long life of the plates.

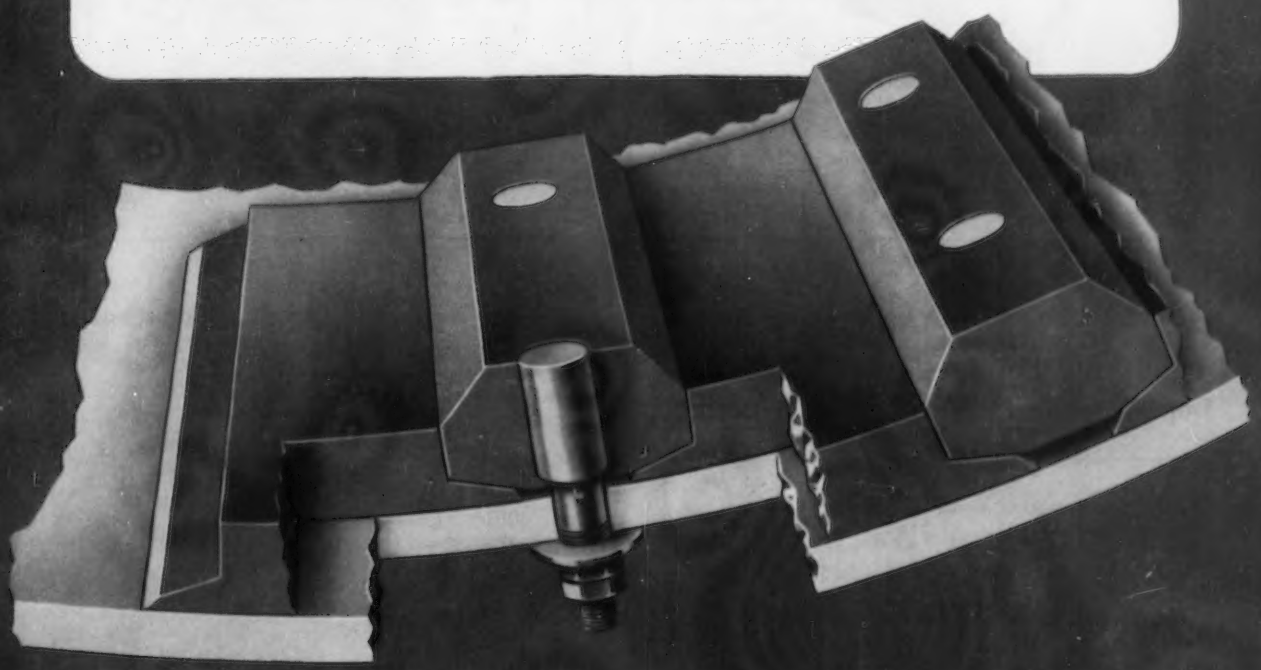
When you use USS Lorain Rolled Plate Linings you get closer tolerances between plates and between plates and lift bars, giving you a tighter overall lining. This means no more shell wash and allied troubles that can ruin the mill itself.

Not only is frequency of replacement reduced with USS Lorain Linings, but the time involved in the actual replacing is less, because these plates are accurately made to size . . . they go in easily, quickly.

Protect your grinding profits. Write to us today for the names of leading mill manufacturers who can supply you with USS Lorain Rolled Plate Linings—for wet or dry grinding.

USS Grinding Balls are designed for economical grinding too. Continual quality checks throughout their production assures you of balls that will take long, rough wear evenly. Sizes from ¾" to 5".

SEE The United States Steel Hour. It's a full-hour TV program presented every other week by United States Steel. Consult your local newspaper for time and station.



UNITED STATES STEEL CORPORATION, PITTSBURGH • COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO • TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

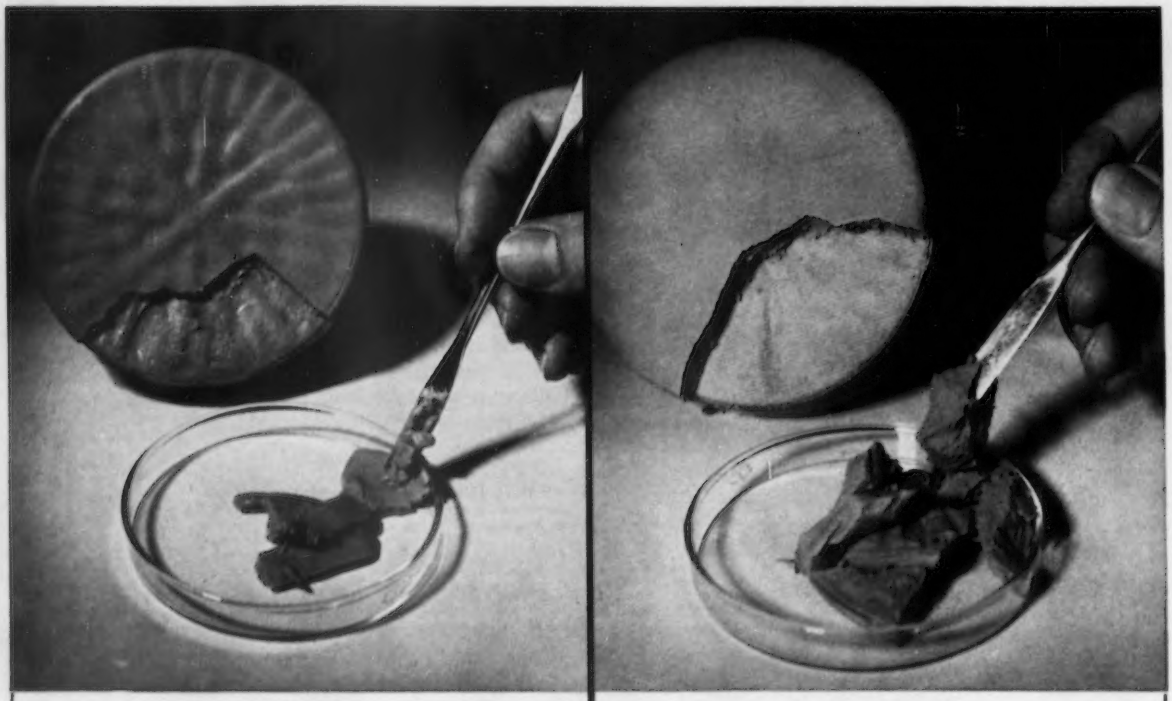
USS LORAIN ROLLED PLATE LININGS *and* USS GRINDING BALLS

USS

UNITED STATES STEEL

Separan 2610

GREATLY IMPROVES FILTRATION



Above picture shows thin cake formed on filter with untreated solids. Cycle includes 15-second cake formation and 45-second drying time.

During the same cycle, a much thicker cake is formed by treating with 0.15 lb. of SEPARAN 2610 per ton of dry solids present.

New flocculating agent speeds up filtration and settling rates, brings many other improvements to liquid-solid separations

THE DOW CHEMICAL COMPANY
Dept. TS 789B, Midland, Michigan

Please send me information and a trial sample of SEPARAN 2610.

Name_____

Company_____

Address_____

City_____ State_____

Prove to yourself the advantages of Separan* 2610 in filtration.

1. Increased cake size
2. Decreased cake moisture and better washability
3. Easy to handle and less dusty cake
4. Less material loss in filtrate
5. Effective over wide pH range

Prove to yourself the advantages of Separan 2610 in settling.

1. Up to 40 times faster settling rate
2. Increased overhead clarity
3. Less materials loss in overhead
4. Reduced cost in acid and alkaline media
5. Increased plant capacity

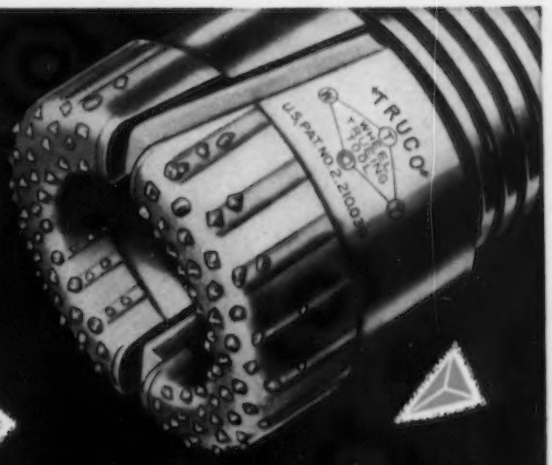
SEPARAN 2610 is highly effective in these industries:

- Uranium
- Clay
- Borax
- Cement
- Alum
- Potash
- Foundry Sand
- Coal
- Phosphoric Acid
- Iron Ore and Taconite
- Industrial Water, and Waste
- Miscellaneous Metals

*Trademark of The Dow Chemical Company

you can depend on DOW CHEMICALS DOW

How to take a "Ribbing" and like it!



with TRUCO Diamond Bits

Truco Diamond Bits and Reamer Shells are "ribbed" where it counts most. Each diamond, because of its natural structure, has a distortion which is known as the "rib" or hard vector and which is the hardest cutting edge on this best of cutting materials. In each Truco bit or shell, the diamonds are set in such a way as to turn this rib into the work. This enables the bit to cut faster and last longer, to give you maximum footage at minimum cost.

This hard vector setting, combined with Truco's "pattern" setting, which puts each diamond where it will do the most good, makes Truco bits and reamer shells the best bet for decreasing your drilling costs. ● Why not find out more about them today? Write ***Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.*** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario*

SPECIAL NOTE: Fast, expert Diamond Resetting Service by Joy helps to decrease your drilling costs! Joy service keeps diamonds at work as much of the time as possible . . . gives maximum salvage value . . . permits resetting in patterns suggested by extreme wear on returned bits.

Consult a Joy Engineer

GET THIS INFORMATIVE BOOKLET D-38A
"DO'S and DONT'S" for DIAMOND DRILLING

WaD M-5651

JOY

WORLD'S LARGEST MANUFACTURER OF CORE DRILLS AND MOTORIZED DRILL RIGS SINCE 1851

Western's dare...You compare!

Check carefully these vital requirements for modern dump car performance before you buy!

COMPARE	WESTERN	MAKE "B"	MAKE "C"	
1. Simple, rugged, enclosed, protected, foolproof door mechanism located at ends of car—(not underneath body).	YES	NO	NO	
2. Car body supported directly upon sturdy draft beam and not on trunnions.	YES	NO	NO	
3. Dual side pivots or trunnions so located to permit dumping of body with least effort and air consumption.	YES	NO	NO	
4. Large capacity air storage reservoirs for minimum time in dumping.	YES	NO	YES	
5. Operator stands in safe position at end of car to dump car. Operating lever protected by end sill.	YES	YES	NO	
Total	100%	20%	20%	

The world's leading mining companies and railroads have been making such comparisons for years...

that's why Westerns are the world's largest selling dump cars!

You, too, can save a great deal more by investing just a little more in Western cars. They'll cut your operating costs, end high maintenance expense on obsolete cars and give long, trouble-free service.

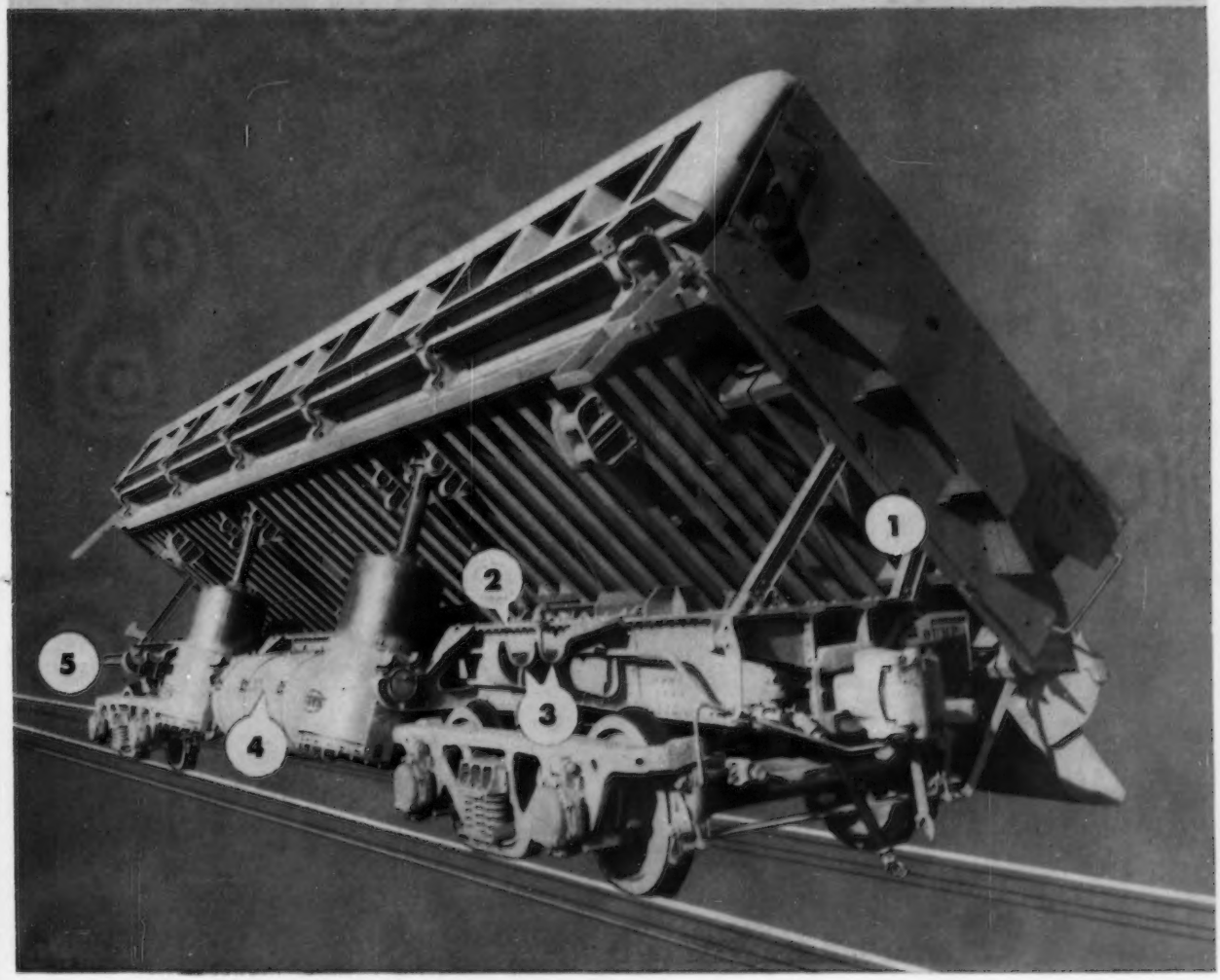
Before you specify . . . *Compare* . . . and you'll buy Westerns!

Write! For complete technical information on Western dump cars (30 to 50 cu. yd.) please address Dept. 6528, Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.

BALDWIN BLH LIMA-HAMILTON

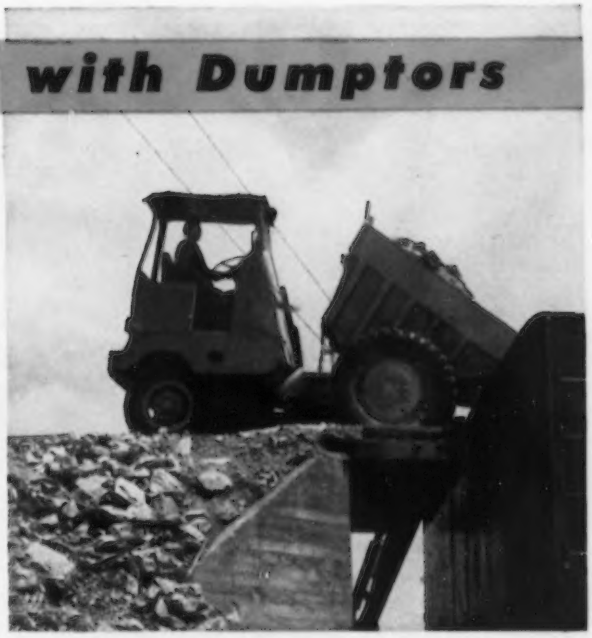
BALDWIN-LIMA-HAMILTON

Philadelphia 42, Pa. . Offices in Principal Cities



Haul underground.
KOEHRING COMPANY, Milwaukee 16, Wis.
Subsidiaries: PARSONS
KWIK-MIX • JOHNSON
K541

. . or on the surface with Dumptors



Trackless mining — Hauling zinc ore from underground mine to railroad siding, 3 Koehring Dumptors ramp-load directly into cars. On this trackless haulage operation, the 6-yard Dumptors are loaded underground by a tractor-shovel. They travel along tunnel to an inclined haul-way, where they have an 1100-foot climb up 11½% grade to the mine entrance. Production for the 3 heavy-duty haulers has averaged 500 tons of ore a day — and the mine foreman reports that maintenance has been "almost nil". It's easy to see why. For one thing, Dumptors have no troublesome body-hoists. *Gravity* dumps the load — and gravity-dump never balks, never wears out.

14 Dumptors in one mine —

On extensive open-pit stripping to uncover lithium deposits, rocky overburden is hauled by a fleet of 14 Koehring Dumptors. They also carry ore from pit to stockpile. Excavating is handled by tractor-type loaders and power shovels. Notice how Dumptor's big square body opening and low rear entry permits fast loading over the end or sides.

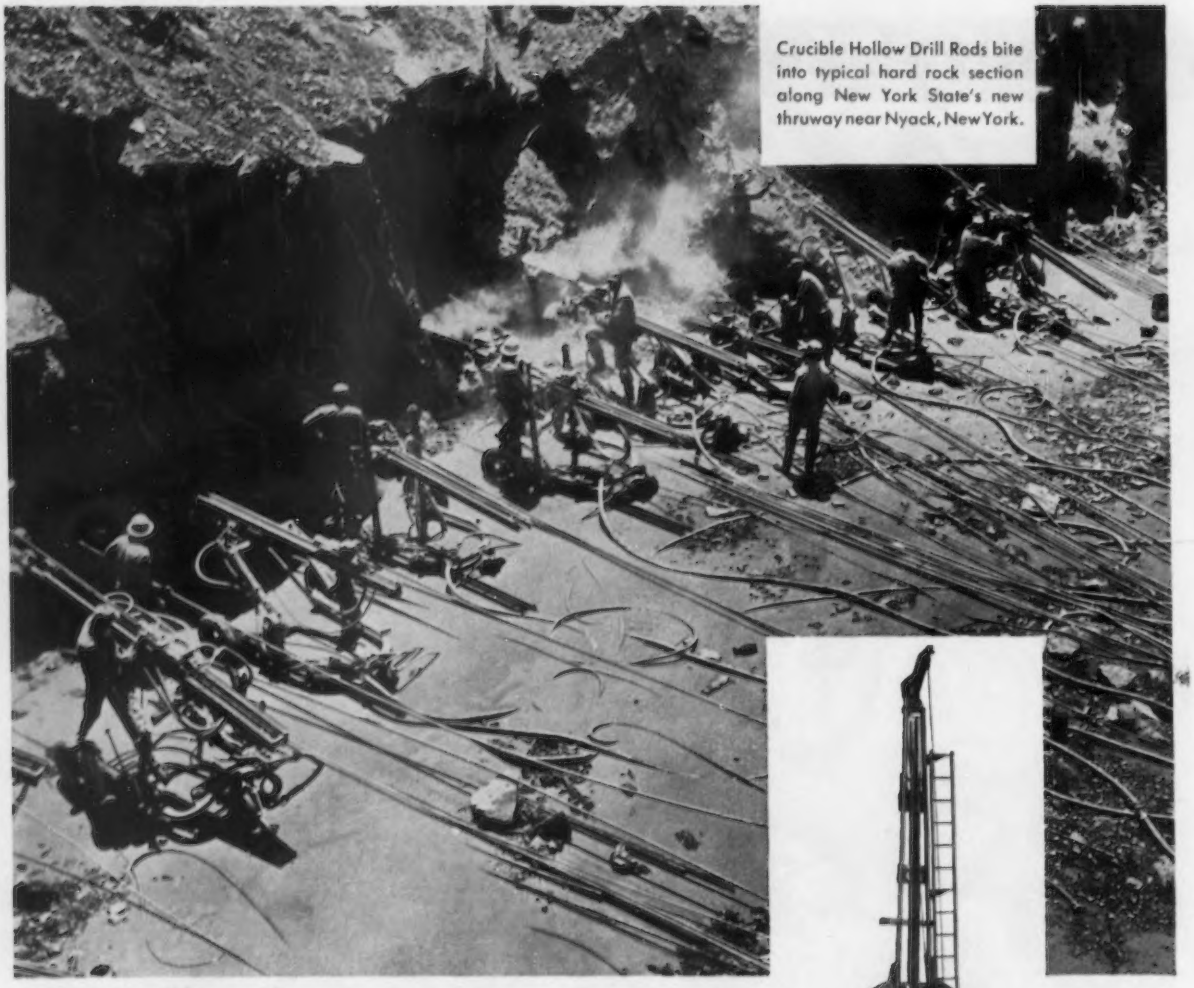
Up-hill haul all the way —

Teamed with a Koehring 1½-yard shovel, 3 Dumptors haul up steep grade out of pit, then climb ramp to dump. These off-road 6-yard Dumptors have better than 6 h.p. per ton of loaded weight. They accelerate fast, pull through soft ground, up grades with less shifting, climb 24% grades fully loaded.

Prospecting for pay dirt —

At exploratory mine in the Rock Mountain region, Dumptor goes underground, shuttles in and out of access tunnel without turning. There's no need to turn, because Dumptor has 3-speed travel in either direction — operates with equal ease coming or going. It's as efficient underground as it is on overhead trestles, or hauling along the surface.

If your work involves hauling rock, gravel, ore and other materials under difficult conditions, let your Koehring distributor show you what this 6-yard heavy-duty Dumptor® can do for you.



Crucible Hollow Drill Rods bite into typical hard rock section along New York State's new thruway near Nyack, New York.

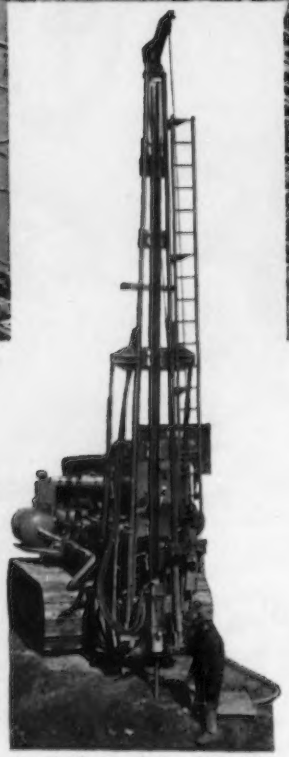
CRUCIBLE HOLLOW DRILL RODS

on the firing line —New York State Thruway

Chewing through hard rock sections of the New York Thruway, Crucible Hollow Drill Rods are helping to build this modern, high-speed highway across the state.

To make this motorist's dream come true meant careful planning by highway engineers—cooperation of dozens of contractors—top quality equipment. That's why large quantities of Crucible Hollow Drill Rods are being used. For experienced construction men *know* they can always depend upon Crucible Hollow Drill Rods for uniformly high performance in the field.

Crucible makes its hollow drill rods to *tool steel standards.* And that means *extra* quality . . . fewer broken rods and lost bits . . . *lowest cost per foot of hole drilled.* Make all *your* drilling jobs go smoothly—specify Crucible Hollow Drill Rods. *Crucible Steel Company of America, Henry W. Oliver Building, Pittsburgh 30, Pa.*



Joy Challenger drill and Crucible Hollow Drill Rod at work on New York State Thruway, Arden, N.Y.

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

E&MJ NEW PRODUCTS DIGEST

Air Powered Underground Loader In Production

Low headroom and wide bucket characterize Eimco Corp.'s latest "Rocker-Shovel" overcast crawler-tractor loader. The air powered Model 630 now in production is designed for underground trackless mining or for drifting ahead of track, as well as for surface work.

Model with lowest dumping headroom —6 ft 8 in—has 6 cu ft bucket. Headroom is equivalent to Eimco's 12B small rail-type machine but bucket is much larger. Standard headroom machine has 11 cu ft bucket, which is 50% greater than Model 21. Larger bucket is available where headroom allows. Discharge heights with minimum headroom model are 44 to 50 in. Variation is obtained by use of raised rails and variable length rocker arms. Width of loader is under 6 ft including step plates.

Rocker arms are newly designed. Digging force at bucket lip is 6,000 lb. Bucket bumpers are on rocker arms to give maximum discharge distance with minimum headroom. Shape and balance of arms and bucket give operation on slopes up to 25%. Bucket drive is separate unit mounted independent from tread drives.

Crawler tracks are driven by separate air motors nested in sides of tractor. Maximum draw bar pull is just over 5 tons. Tracks have spring release to clear rocks and obstructions. With standard 9-in. shoes, ground pressure is about 11½ psi; with 14-in. shoes, about 5 psi, for good support in soft ground. Special track shoes and grousers are available.

Air controls are simple and may be mounted on either side or in special positions to suit operating conditions. Built-in safety shut-off valve and automatic air line oiler give motors longer life.

Electric powered machines are available, and so are various types of dozer blades, fork lifts, timber setting machines, winches and similar attachments. Also offered are accessory hoppers, up to 40 cu ft, to make a self-loading transport. **(1)**

EXPERIENCE of Salt Lake City, Utah, firm in making rail and diesel-crawler types of overcast loaders was valuable in designing the Model 630.

← CORE DRILL (3)

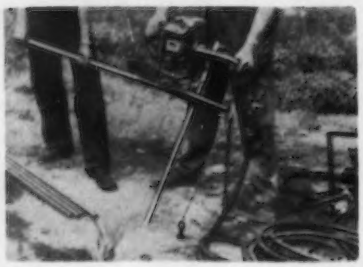
This whole diamond core drill rig weighs a little over 200 lb except for the rods. Rods, 5 ft long, weigh 4.3 lb each. Rated for 300 ft, it cuts a 3/8 in. by 5 ft core making a 1 1/16 in. hole. The outfit includes pump and mud tank for circulating water, air cooled gasoline engine for power, swivel head for drilling at any angle, and an aluminum alloy tower and frame. Called the "Mini-Drill," it is made by Du Jac Mfg. Corp., Houston, Texas. Set up takes only 10 minutes according to release.

DRILL CARRIAGE (4) →

Gardner-Denver claims the self-propelled "Air-Trac" is superior to conventional wheeled mounts on steep, rough and rocky terrain. Mobility for quick, accurate spotting and stability even with the tracks tilted is emphasized. Mounted on two crawler treads, each air motor powered, the T-bar supporting the chain feed is positioned by two hydraulic cylinders actuated by a hand pump. It swings through a vertical arc of 86½ deg for angle or toe holes. Can tow 5-ton compressor up 10% grade as well.

VIBRATING SCREEN (5)

Claimed to operate on 50 to 75% less power than conventional models, the "Hi-G" vibrating screen made by Hewitt-Robins, uses a controlled resonance action. The screen frame is mounted on a unique system of steel springs and rubber. Actuated by a relatively small mechanical exciter, its fewer parts reduce maintenance.



TC DRILL BITS (10)

Designed for use on the new, larger machines, Brunner & Lay, Franklin Park, Ill., offers X-type, tungsten-carbide "Rok-Bits." They are available in 3½-, 4- and 4½-in. gage sizes, to fit on either 1½- or 2-in. drill rods, eliminating the use of expensive adapters. They feature a new body design, job-fitted carbides, says the manufacturer.

CONVEYOR BELT (6)

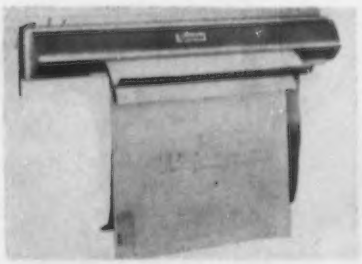
Super Raynile, synthetic fabric, makes new conveyor belting 4 times stronger than cotton reinforced types, says Hewitt-Robins. For extra long conveyors, it is less expensive than steel reinforced belts and can be quickly and simply spliced in the field. First installation is to be underground—2,065 ft long, rising 610 ft in Indiana gypsum mine.

CORE DRILL (8)

Packsack Diamond Drills Ltd., has a one-man, hand-held core drill that puts down a 50-ft hole with a 1¼-in. diamond bit and can give a ⅞-in. core. The components, small size and lightweight—200 lb rods and all—make back packing easy. Gasoline engines power both drill and pump. It is made in North Bay, Ontario, Canada.

ROOF BOLT BEARING PLATE (11)

A round sandwich of rubber in steel provides a new way to determine roof bolt tension according to USBM. Used as a compression pad between the rock and nut or head of the bolt, the plate was developed by the Bureau and Goodyear Tire and Rubber Co. Measuring lateral expansion of rubber is more accurate than torque wrench.

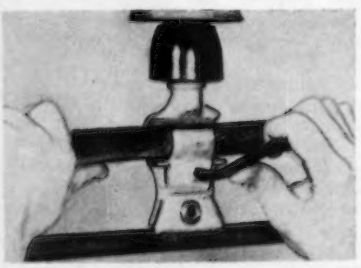


WHITEPRINTER (7)

Rotolite Co., Basking Ridge, N.J., has a low cost machine that can be plugged into any standard wall socket and requires only a minimum of wall, floor or desk space. Tracings and paper are drawn through and exposed automatically. A dry developer produces a whiteprint copy in less than a minute. It comes in three sizes, 18- to 42-in. wide.

POWER WHEELBARROW (9)

The "Workhorse" can carry a full, 400-lb load up a 16% grade without hesitation and with little effort by the operator according to a release from Worthington Mower Co., Stroudsburg, Pa. The 2½-hp gasoline engine is reported easy to start. Controls are on handles. Dumping is easy by tripping catch and lifting handle on tray.



TROLLEY WIRE HANGER (12)

Separate clamps permit trolley wire and feeder to be hung independently when using the hanger made by Ohio Brass Co., Mansfield, Ohio. Frequently just the trolley wire needs to be extended, then later feeder is needed. Such a job is more simply done with the new device than with the separate or combination hangers formerly available.

SYMONS VIBRATING BAR GRIZZLIES

. . . up to 500 tons per hour
handling feeds ranging to power shovel size

The SYMONS Type-K vibrating manganese Bar Grizzly is recommended for large tonnage *Scalping* of ore, rock or gravel. The powerful vibrating action of the Bar Grizzly makes it particularly effective for wet, sticky or gummy materials. The sloping, curved bars of the Symons Bar Grizzly tend to cascade the material as it passes over the screening surface. The tumbling action effectively assists in separating the undersize. Will handle feed sizes up to 30″ and larger.

For full details about the SYMONS BAR GRIZZLY, send for BULLETIN 121A.

FOR HEAVY DUTY SCALPING SERVICE

For full details about the SYMONS ROD GRIZZLY, send for BULLETIN 207.

SYMONS VIBRATING ROD GRIZZLIES

. . . up to 500 tons per hour
for feeds up to 10″ — 12″

The SYMONS Type-K—RG vibrating Rod Grizzly is built for heavy duty scalping service in large tonnage operations . . . bridging the gap between primary breaking and the secondary crushing and screening operations. It can readily handle dry, wet, sticky or gummy ores and rock. Some of the important features include:

Abrasion resistant heavy spring steel rod screening surface; Long lasting, low cost rods are easily adjusted or replaced; Effective, vigorous vibration provides thorough scalping; Amplitude of vibration can be quickly and easily changed to meet various operating conditions. Ideally suited for service following most sizes of primary crushers and scalping operations requiring relatively coarse separations in the range between 1″ to 4″.

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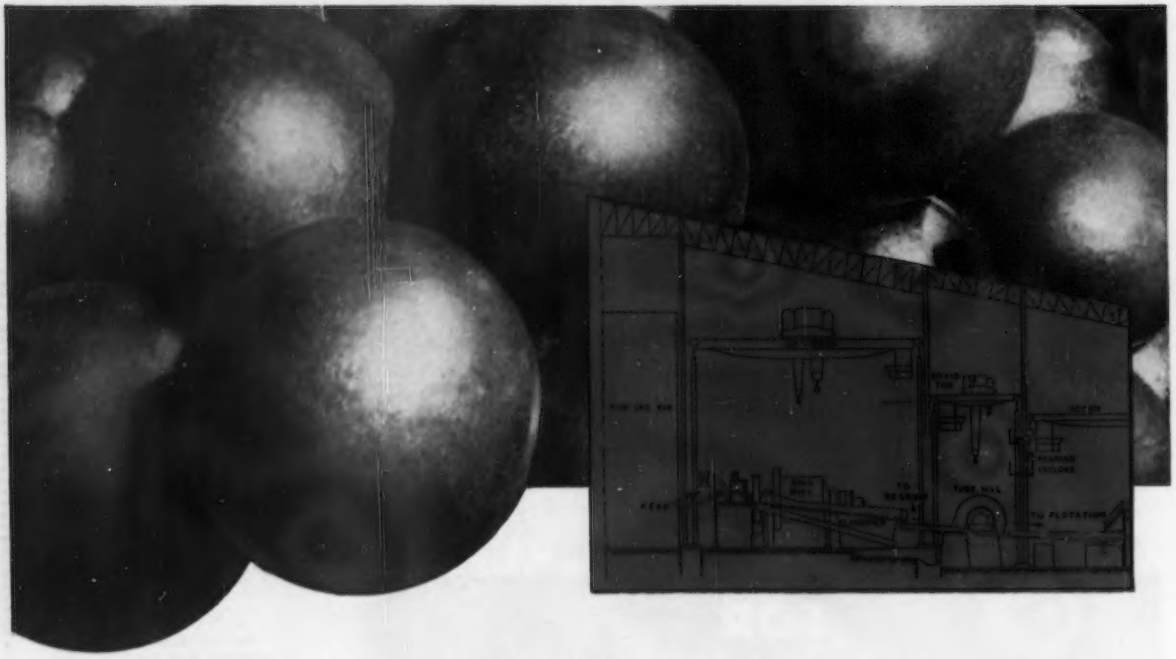

for superior resistance to abrasion and impact in wet grinding...

CF&I GRINDING BALLS

You'll find that CF&I Grinding Balls are ideal for most types of wet grinding because they combine excellent resistance to both abrasion and impact. Because of this combination of properties, they can be used economically in wet grinding mills, operating at high or low speeds, with either high or low pulp concentrations.

CF&I Grinding Balls give this superior service because they are forged from special analysis steel. Since they are free of surface imperfections, CF&I Grinding Balls wear evenly. Further, each ball is carefully inspected throughout production and immediately before shipment to make certain that it has no surface pits, circumferential ridges or other surface unevenness.

CF&I Grinding Balls are available in diameters from ¾" to 5". For full details, get in touch with your nearest CF&I Sales Representative.

CF&I Steel Products for the Mining Industry

Rock Bolts • Grinding Rods
Wickwire Rope
Mine Rails & Accessories
Cal-Wic Industrial Screens

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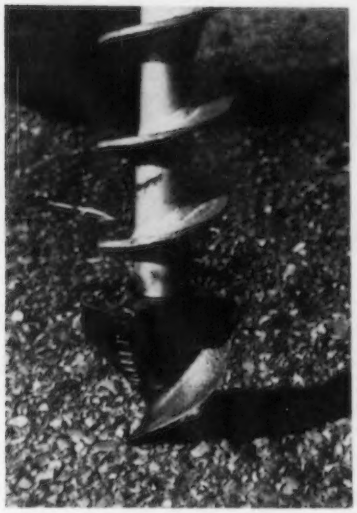

ROCK AUGER FIT (13)

"Pengo" fish tail screw bits are the most economically priced drill head on the market according to Petersen Engineering Co., Santa Clara, Calif. They say it drills very fast through sandstone, limestone, shale and other material except solid hard rock. Designed to attach to any continuous helix type auger, it is available in ten sizes from 2½ to 10 in. for up to 300-ft holes.

FRAMING ANCHORS (14)

"Trip-L-Grips" make stronger, more rigid nailed joints, according to Timber Engineering Co., Washington, D.C. The zinc coated sheet steel devices come in three basic styles to eliminate the uncertainties and weaknesses of toenailing timber frames. These Teco framing anchors make ledger strips and notches unnecessary as well as increase rigidity to resist wind forces better.

WHEELED SCRAPER (15)

Heaped capacity of 41 cu yd makes Woolridge Mfg. Div., Continental Copper & Steel Industries, Sunnyvale, Calif., believe "Terra-Clipper" OS 300 scraper is largest standard model available. Wider base tires give greater flotation and carrying capacity. Tractor drawn and cable operated, they are designed to utilize the tremendous power of the large tractors now available.

TRACTOR SCOOP (16)

Rear attachment for Ford tractor can scoop up, transport and dump bulk or dimensioned material. Bucket can be turned around for forward or reverse digging and dumping, and can be held vertical for leveling. Operated from seat, mechanical trip lever dumps and resets scoop; hydraulic system raises and lowers it Made by Ford Motor Co., Birmingham, Ill., it digs to 6-in., carries 7 cu ft.

CERAMIC COATING (17)

Sprayed on by feeding powdered ceramic material through a simple flame gun, new method of coating is called "Flame Spray Ceramics." Developed at Armour Research Foundation, the process has been licensed to Continental Coatings Corp., Chicago, Ill. Coating, heat and chemical resistant, consists of sintered layers of either of two stable oxides, aluminum or zircon. Base is not heated unduly.

CUTTING LUBRICANT (18)

Drilling, tapping and reaming metals are aided by "Metalube" says Protective Coatings Inc., Detroit, Mich. The lubricant comes in small squeeze tubes for handy bench use as well as in larger containers. The new compound is reported to have upped drill life eight times, tap life four times and production two and one half times. It is also claimed to give smoother, cleaner and more accurate work.

Super Scale for Conveyors
Builders Conveyoflo is unsurpassed for accurate weight-metering of belt conveyor flows. Pneumatic system gives full-range metering with minimum vertical belt deflexion. Compact — no overhead framework or complicated lever arms. For Bulletin 550-H4A, write Builders-Providence, Inc., 391 Harris Avenue, Providence 1, Rhode Island.
BUILDERS-PROVIDENCE
DIVISION OF B-I-F INDUSTRIES, INC.
METERS FEEDERS CONTROLS

AFCO FORGED

"ICDH" BALLS

CUT GRINDING COSTS

For alloy-type performance at carbon ball prices try AFCO "ICDH" grinding balls. These tough balls are forged from "improved carbon" steel, then deep hardened for maximum resistance to abrasion. They're as uniform as can be made to assure you even wear and retention of shape. They wear 6 to 10% longer, yet cost no more than ordinary carbon balls. Try "ICDH" (that's improved carbon deep hardened) balls NOW. Available only from AFCO. Sizes: ¾" to 5".

OTHER AFCO GRINDING MEDIA
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For quotations, phone, write or wire us NOW.

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Portland, Oregon
Los Angeles, Calif.
Salt Lake City, Utah

E&MJ NEW PRODUCTS DIGEST

SMALL DIESEL (19)

Continuous output of 12 bhp at 3000 rpm is obtained from this 154-lb diesel. Compression ratio of only 1:11 reduces loading on parts. Called the "LT 85," it is manufactured in Germany by Triumph Werke Nurnberg A.G. Low fuel consumption is claimed.

LIFT TRUCK (20)

"Monomast" has single upright for increased visibility which eases operation of the fork-lift truck, made by Hyster Co., Portland, Oregon. The mast itself consists of two box type sections, one telescoping within the other, and has good rigidity. Hoist speed has been upped.

TENTING (21)

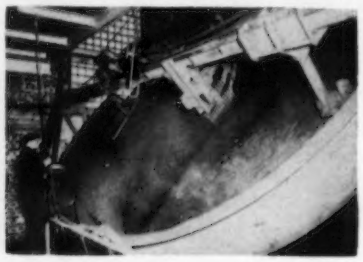
Light weight and strong, nylon and vinyl plastic film are incorporated in making the new "Herculite" line of tents and tarps from Fellowcraft Engineering Inc., Newark, N.J.

FILTER PAPER (22)

"Super-Netone" from National Filter Media Corp., New Haven, Conn., is strong neoprene-impregnated filter paper. Low cost, it comes in several weights and can replace or extend life of cloth.

LIFTING DEVICE (23)

Operating on vacuum principle, large pads of "Vac-U-Lift" grip any non-porous surface for lifting. International Staple & Machine Co., Herrin, Ill., makes the device. Object to be lifted must have surface large enough for pads to attach themselves. Curved pads are available. It operates on cement and concrete products, pipe, paper cartons, metal plate and even diamond tread steel plate.



PELLETIZER (24)

Large rotating disk produces iron ore without using binder, plasticizer or solid fuels, according to Dravo Corp., Pittsburgh, Pa. Developed in Germany four years ago, "Lurgi" pelletizing disks are made in the U. S. by Dravo. Machines have been in use abroad for some time and are going into Inco's new $16,000,000 plant near Copper Cliffs, Ontario. Shown is 16-ft disk.

CONVEYOR BELT (25)

Fire resistance of conveyor belt developed by Hewitt-Robins Inc., Stamford, Conn., comes from use of neoprene synthetic rubber throughout. Neoprene will char if brought into contact with flame but will not burn after flame is removed. Cost of belting will be about 15% higher than usual types but according to manufacturer this will be offset by longer life.

SOLID LUBRICANT (26)

"Bonded to the surface" solid film lubricants have recently been patented by Electrofilm Inc., North Hollywood, Calif. Said to function at extremely high or low temperatures—minus 100 to plus 750 deg F—they are reputed to prevent galling, seizing and fretting corrosion even after long idle periods and to be ideal for high loads and speeds.

ALLIS-CHALMERS
Rubber-Lined
PUMP

Up To 50 Times Longer Life

than best alloy pumps for handling fine mesh materials

PERFORMANCE records from twenty years of handling all types of slimes, slurries and other fine mesh abrasive suspensions show definite savings from the use of Allis-Chalmers Rubber-Lined Pumps. Instances of 10 to 50 times the life of the finest alloy pumps built for this service are common. Not only are pumping costs reduced, but production lost from shutdowns is almost eliminated and standbys often can be done away with.

Unique Lining Method

One secret of this amazing record is the rubber lining of the Allis-Chalmers pump. It is bonded to a heavy steel skeleton which is simply fitted into the casing. The lining and the casing are not bonded together. When the lining finally must be renewed, the pump need not be removed from its location. Replacement cost is kept to a minimum.

Each Installation Specially Engineered

Every pump is individually engineered to provide the best possible performance for the application involved. Special rubber linings of various compounds are available to handle a variety of slurries at low per-gallon pumping cost. Allis-Chalmers can furnish a complete coordinated pumping unit — pump, motor, control and drive — ready to install and run.

If you are handling sand, taconite, grinding mill discharge, tailings or any other abrasive slime or slurry, ask your Allis-Chalmers representative to show you how you can get long pump life and low cost per gallon pumped. Or write Allis-Chalmers, Milwaukee 1, Wisconsin, and ask for Bulletin 52B8156. A-4768

A-C ALLIS-CHALMERS

ALLIS-CHALMERS

Bucyrus-Erie 88-B Shovel Design Increases Digging Power, Digging Speed, Digging Life

For sustained high output in heavy-duty service, here's an excavator that will meet your demands fully — the Bucyrus-Erie 4-cu. yd. 88-B. Three important advantages contribute to the 88-B's high production performance: superior quality construction that stands up under digging stresses; front-end design that applies power efficiently; and overall machine balance that means smooth operating control. Illustrated here are some of the benefits you get; for the *full* story see your nearest Bucyrus-Erie distributor.

MORE DIGGING POWER

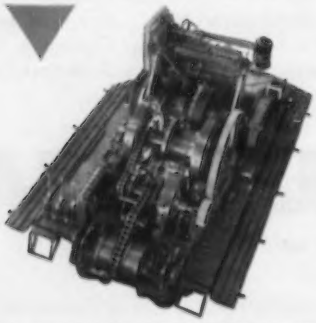
New 88-B positive twin rope balanced crowd system automatically helps operator to proportion speeds and forces properly between hoist and crowd . . . provides greater digging force. Powerful diesel engine is equipped with torque converter drive.

FASTER DIGGING SPEED

Dig, swing, and dump motions are superbly balanced by Bucyrus-Erie Individual Design. There is no overdippering, underpowering, or excess weight to prevent the operator from getting the exact responses he wants. Clutches are engaged and brakes set by full air control, not just air assist.

LONGER DIGGING LIFE

Neat, compactly arranged deck machinery is real evidence of outstanding engineering. Parts are simple yet strongly built, and are easy to get at for routine maintenance. Power is smoothly, quietly transmitted by the most direct route through anti-friction bearings.



To meet *your* job conditions, you can take your choice of three crawler mountings — standard with flat ends, long with tapered ends, or long with flat ends. Four A-frames are offered: standard high and low frames, and power-controlled high and low frames. Front-end equipment for crane, clamshell, dragline and stripping shovel operations is available. Power boom hoist is standard equipment; an independent friction-type boom hoist is also available at extra cost. 138E55C

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South Milwaukee Wisconsin

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E&MJ NEW PRODUCTS DIGEST

For Your Files

This informative manufacturers' literature is free unless otherwise specified. To obtain bulletins circle their numbers on card below and mail.

MEETING ROOM EQUIPMENT IDEAS is a "do it yourself" booklet put out by Reynolds Metals Co., Louisville, Ky. It shows 10 items easily made from aluminum that are attractive and inexpensive. **(51)**

AIRCO PUBLICATIONS are listed in a 16-page booklet. All phases of welding and cutting are covered in the more than 100 pieces of literature indexed by Air Reduction Sales Co., New York, N. Y. **(52)**

STEEL TERM DICTIONARY and Engineering Data is published in a 32-page booklet by LaSalle Steel Co., Chicago, Ill. Containing many photos, graphs and tables, it is of particular value to those who buy or use cold finished steel. **(53)**

PNEUMATIC STANDARDS for Industrial Equipment, revised earlier this year at J.I.C., are available from Miller Fluid Power Co., Chicago, Ill. Graphic symbols, glossary and other information are presented as well in the 12-page booklet. **(54)**

VARIABLE SPEED PULLEY selection and installation is topic of brochure by Equipment Engineering Co., Minneapolis, Minn. Seven steps are given for getting correct pulley system. Company makes "Hi-Lo" line. **(55)**

HARDSURFACING electrode specifications and procedures for tractor parts are presented in a handy reference chart from Rankin Manufacturing Co., Alhambra, Calif. Also available is a cutaway template that can be used to measure wear on parts of Caterpillar tractors. **(56)** and **(57)**

X-RAY ANALYSIS is discussed in 8-page booklet from North American Philips Co., Mount Vernon, N. Y. Presented as 20 questions and answers, the information gives quick understanding of method. **(58)**

MAGNETIC-PARTICLE TESTING is another question and answer discussion of procedures and applications of a flaw detection method for metals, issued by North American Philips Co., Mt. Vernon, N. Y. **(59)**

FLOTATION REAGENTS called "Armacs" are described in booklet prepared by Armour & Co., Chicago, Ill. Acetic acid salts of fatty amines, they are cationic materials which have ability to be adsorbed on metallic and non-metallic surfaces from liquid systems. **(60)**

CASTING PROCESS called "Ceramicast" is described in sales bulletin from Lebanon Steel Foundry, Lebanon, Pa. Ceramic molds are used which give smooth surfaces, intricate shapes, thin sections and thus cut machining costs. Almost any casting can be made. **(61)**

ACOUSTICAL PLASTIC made with vermiculite is given comprehensive treatment in new booklet says Vermiculite Institute, Chicago, Ill. It might help in noise reduction safety programs. It is fire proof as well. **(62)**

CALCIUM CHLORIDE handling in bulk is illustrated and described in a booklet from Dow Chemical Co., Midland, Mich. It especially mentions "Peladow," a pellet form of the hygroscopic material. **(63)**

RADIATION INSTRUMENTS for prospecting and mining, available from Victoreen Instrument Co., Cleveland, Ohio, are presented in an illustrated catalog. **(64)**

AUTOMATIC DOORS for a variety of installations are cataloged by Stanley Works, New Britain, Conn. There are two basic types: Magic Eye and Magic Carpet. Selection and installation are covered. **(65)**

SYNTRON EQUIPMENT cover a wide range of vibratory apparatus, rectifiers, tools, materials handling devices and miscellaneous items. Condensed catalog gives data on all models made by Syntron Co., Homer City, Pa. **(66)**

METAL POWDER PRODUCTS made by Chrysler Corp., Detroit, Mich., are comprehensively covered in an Engineering Manual just released. "Oilite" is the trade name given to all the products. Oil impregnated bearings and bearing materials, precision machine parts and metal filters are the three general classes given. **(67)**

CARBIDE TOOLS AND BLANKS are priced and described in catalog from Adamas Carbide Corp., Kenilworth, N. J. The booklet features a guide to selection of steel cutting grades. **(68)**

ELECTRICAL AND LUBRICATING DEVICES made by Trico Fuse Mfg. Co., Milwaukee, Wis., are shown in condensed catalog. Sizes and general engineering data are given on fuses, oilers and accessories. **(69)**

WIRE AND CABLE insulated with silicone rubber for high temperatures and smaller diameters are listed and described in a catalog from General Electric, Bridgeport, Conn. **(70)**

ELECTRICAL CONNECTORS made by Joy Manufacturing Co., Pittsburgh, Pa., are cataloged in bulletin. Plugs and receptacles of wide variety are shown. **(71)**

JULY 1955

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E&MJ NEW PRODUCTS DIGEST

SANDBLAST EQUIPMENT from Clementina Ltd., San Francisco, Calif., is covered in catalog entitled "Sandblast with Clemco." Many size models and accessories are shown. (72)

RUBBER catalog for molded goods and industrial sheet packing has been issued by Hewitt-Robins Inc., Stamford, Conn. Advantages of the six types available for molding and the ten available in sheet are listed. (73)

LABORATORY REAGENTS offered under the name of Baker & Adamson are listed and specified in a new general catalog prepared by General Chemical Div., Allied Chemical & Dye Corp., New York, N. Y. The book is available to those who specify and buy lab chemicals. (74)

WALKING DRAGLINES get mentioned this month through a release by Page Engineering Co., Chicago, Ill. Features and functions of each working mechanism are described and specifications for each model are tabulated. Size range is from 5 to 15 cu yd. (75)

CONTINUOUS MINERS made by Goodman Manufacturing Co., Chicago, Ill., are dealt with in an 8-page release. Line drawings and photographs supplement the text and clearly show the functioning of the principal parts. Cutter bars break the wedges left by two large rotating bore heads and even up the roof and bottom in coal and some other soft rocks. (76)

OVERSHOT LOADERS made by Austin Div., Central Ohio Steel Products, Galion, Ohio, are covered in a series of five 2-page sheets. Over-all dimensions are given as well as capacities and attachments. (77)

RUBBER-TIRED TRACTOR SHOVELS offered by Clark Equipment Co., Benton Harbor, Mich., are shown in a 12-page booklet. The company claims the "Michigan 175-A," 2¼ cu yd capacity, is the largest one available. Advantages of design and operation are explained and illustrated. (78)

HAULAGE WAGON for moving, dumping or spreading 25 cu yd of rock and earth is shown in brochure from C&D Manufacturing Co., Perkins, Calif. The all-purpose four wheel "C&D Movall" is designed for towing by Caterpillar wheeled tractors and has positive, controlled side, bottom or end dump mechanisms. (79)

AIR COMPRESSOR, Model 20T, manufactured by Ingersoll-Rand Co., Phillipsburg, N. J., is a small, 20-hp, air-cooled piston type. It is described in a bulletin recently issued. A special type valve is featured. (80)

CLOSE-COUPLED PUMPS are specified in a recent bulletin from Allis-Chalmers Manufacturing Co., Milwaukee, Wis. Model C-3 "Electrifugal" pumps can handle up to 2500 gpm at heads up to 400 ft. Supporting adapter makes a single unit easily installed and maintained in service. (81)

MOBILE MILLS AND LABS from Denver Equipment Co., Denver, Colo., are designed for actual milling or for testing and development of milling procedure. Brief bulletin on them has just been released. Truck mounted, complete, compact units are recommended by company for organizations with widespread holdings or exploration programs. (82)

WET CYCLONE branded "FR Dorr-Clone" is a completely rubber lined classification unit described in bulletin from Dorr-Oliver Inc., Stamford, Conn. The publication cites engineering data as well as operating results from three commercial installations. Various replaceable rubber molded inserts are combined to form a series of three sizes 6, 12 and 24 in. in diameter. The separations are made at the 25 to 60 micron size. (83)

AIR CLASSIFIER, the "Gyrotor," is a gravity-type device that uses a conical shaped rotor which is faced with slat-like blades. At relatively low speeds the rotor produces a swirling air current that effectively separates at sizes from 35 mesh down into the low micron range. Capacity is from a few pounds to over 50 tons per hour. The maker, Hardinge Co. Inc., York, Pa., has issued a bulletin on it. (84)

CENTRIFUGAL AIR WASHERS, wet process dust collection units, from Ducon Co., Mineola, N.Y., are described in a 4-page brochure recently published. Air swirls upward through vanes and water sprays which remove particles. (85)

FLUID POWER transmission systems and components are more desirable than other mechanical devices for operating equipment according to the bulletin from National Pneumatic Co., Boston, Mass. The folder describes some of the pneumatic-hydraulic devices they make. (86)

FLUID PRESSURE BOOSTER with reciprocating action is explained in pamphlet from Miller Fluid Power Co., Melrose Park, Ill. Several typical circuits are diagramed too. (87)

GAS OR GASOLINE ENGINE developing 75 to 80 hp at 2400 rpm is described in bulletin from International Harvester Co., Chicago, Ill. Full specifications and performance charts on the "U-282" are given, as well as description of available attachments. (88)

HYDRAULIC PUMPS, designed to meet the special conditions of service encountered on mobile equipment applications, are described in single page bulletin from New York Air Brake Co., Cleveland, Ohio. They are called Series PFM-100 Dudco balanced dual-vane pumps. (89)

(PLEASE GIVE THIS ADVERTISEMENT TO YOUR BLASTING FOREMAN)

I'm using Primacord

"You understand . . . I don't *like* thunderstorms. No blaster does. But ever since that job in Kentucky when a direct hit failed to detonate Primacord, I make it a point to use this detonating fuse during the thunderstorm season."

Here's the reason. Primacord is an insensitive detonating fuse. It is not affected by stray electrical currents. It cannot be set off by friction, sparks or ordinary shock. It must be detonated with a blasting cap.

Primacord is used to detonate the entire load in each hole, and to connect all holes in planned sequence to produce *good digging*. A detonating cap is attached to the Primacord only after everything is ready . . . when men and machines are out of the danger zone.

Use Primacord wherever there is danger of stray electrical currents — and particularly during thunderstorm seasons.

For more information see your Explosives Supplier, or write to

THE ENSIGN-BICKFORD COMPANY
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Primacord — Quarrycord — Ignitacord® Safety Fuse — Blasting Accessories
Established 1836

To connect a Branch Line of Plastic Reinforced or Plastic Wire Countered Primacord with the Trunk Line

use this DOUBLE HITCH in the textile-covered Primacord Trunk Line. *Draw it up as tight as you can, and make sure that the Branch Line leads off at a RIGHT ANGLE to the Trunk Line.*

PRIMACORD®

DETONATING FUSE

PROVED AND APPROVED

P-21

Cut the Primacord off the Spool Immediately

Make this a safety habit! As soon as you have taken off the length of Primacord you need for a down-hole or for a trunk-line, cut it off the spool! Don't waste a second — do it now!

To connect the Detonator with the Primacord Trunk Line

use FRICTION TAPE. You can detonate Primacord with fuse and cap or electric blasting cap. Lay the cap alongside of the Primacord with the business end of the cap pointing in the direction that the Primacord will detonate. Tape the two snugly together, so that you have a tight connection.

To connect a Branch Line with the Trunk Line

Use this HALF HITCH for Plain and Reinforced Primacord. *Draw it up as tight as you can, and be sure the Branch Line leads off at a RIGHT ANGLE to the Trunk Line.*

To lengthen a Trunk Line

of Plain or Reinforced Primacord, tie a SQUARE KNOT. *Draw it up as tight as you can* — it won't slip back. Caution: don't use any knot in a hole — it might break or hang up explosives when loading.

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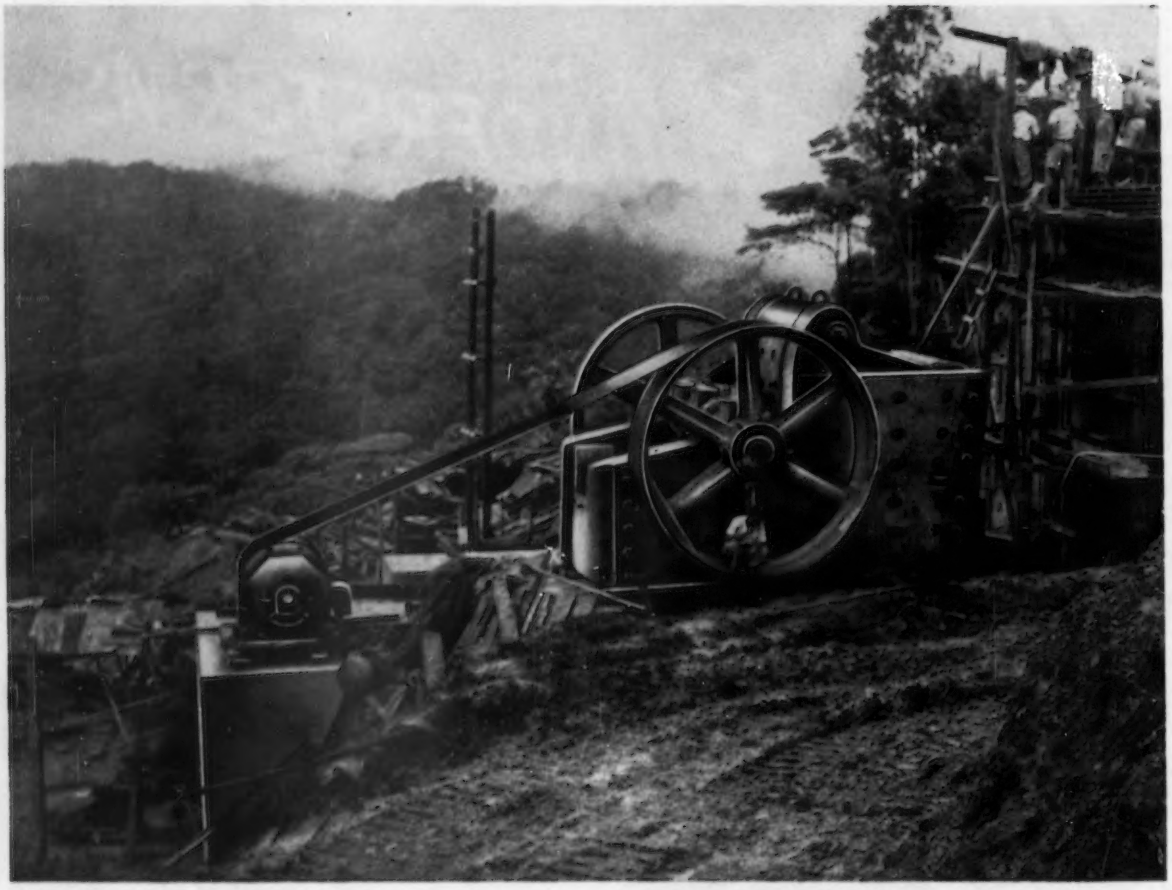

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Traylor Type S Jaw Crushers . . . the most massive jaw crushers ever built . . . are scientifically engineered to stand up to the most severe production schedules in the mining field. Type S crushers are "Traylor-Made" with Traylor's famous curved jaw plates to meet your particular requirements and specific operating conditions. Available in seven sizes, with feed openings from 36″ x 42″ to 60″ x 84″, Traylor Type S Jaw Crushers offer capacities up to 1,000 tons per hour.

Bulletin 125 outlines the exclusive design features of Type S Jaw Crushers and contains full specifications. Send for your copy of this free bulletin today.

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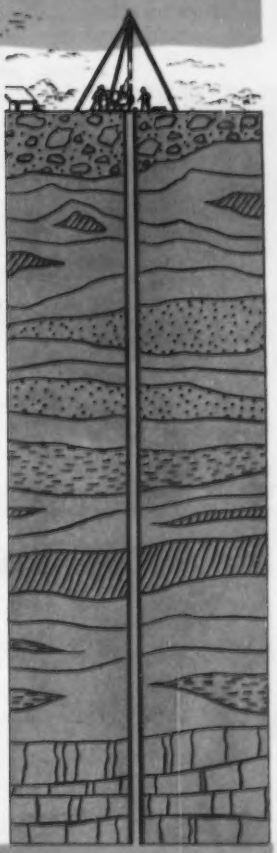

Geological studies, geophysical tests and experienced professional advice—separately or in combination—can tell you quite a lot about that part of an ore body that lies near the surface but when you need to know what's down underground, there's no substitute for a properly planned program of Diamond Core Drilling.

And that's where we come in. The efficient organization and improved equipment developed during more than seventy years of successful world-wide experience enable us to obtain a high percentage of good core from almost any rock or ore formation. Unfavorable conditions are overcome, in many cases, by the use of special tools developed by our own engineers and manufactured in our own extensive shops.

When properly analyzed these good cores not only prove the extent of ore bodies but also permit both physical and chemical examination of the ore that will be mined during the next month, the next year or the next twenty years—your best possible guide to continuously profitable operation.

Compared to the benefits derived, the cost of our exploratory core drilling service is very modest and we welcome opportunities to submit estimates; without charge or obligation of any kind.

SPRAGUE & HENWOOD, Inc., Scranton 2, Pa.

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Leading Manufacturers, also, of High-Speed Diamond Core Drilling Machines, "Oriented" Diamond Bits and a complete line of Improved Accessory Equipment for Core Drilling and Soil Sampling. Write for illustrated catalogues containing complete specifications and all necessary working data on:

Auger Bits, all types
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Couplings, Rod
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Drive Heads
Drive Pipe
Drive Pipe Couplings
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Hoisting Rings
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Plugs, Hoisting
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Protectors, Casing
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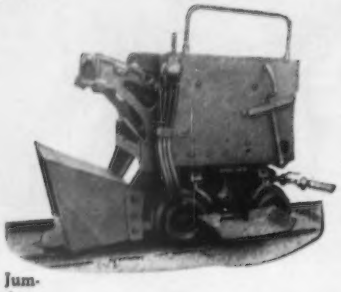
Low-cost development and production with engineered deep hole percussion drilling equipment. Deep Hole Drills, Ring Seal Shank, Long-Feed Mountings, Sectional Rods and Couplings. Bulletin DHPD-1.

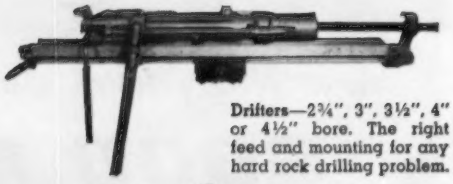
Compact and efficient air compressors.



Mine Car Loaders — fast, powerful, safe.

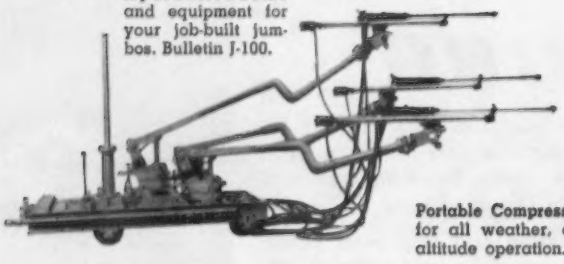
Stopers — direct or telescopic - direct feed leg. Two sizes: 2¾" and 3⅛".

Sinkers—hand-held or feed-leg mounted. The right combination for every rock.

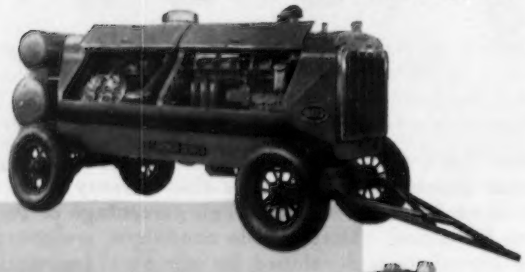


Drifters—2¾", 3", 3½", 4" or 4½" bore. The right feed and mounting for any hard rock drilling problem.

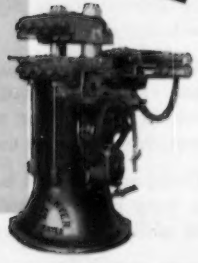
Hydraulic Drill Jumbos. *Tractor Jumbos.* Hydraulic Booms and equipment for your job-built jumbos. Bulletin J-100.



Portable Compressors for all weather, any altitude operation.



Increase Your Mining Profit with help from Gardner-Denver



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A Sump Pump that won't bury itself in mud.

Duplex Power Pumps for mine de-watering and water supply. Grout Pumps, air or steam operated.

High torque Airslushers and Air Hoists.

Write for descriptive information.

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GARDNER-DENVER

THE QUALITY LEADER IN COMPRESSORS, PUMPS AND ROCK DRILLS FOR CONSTRUCTION, MINING, PETROLEUM AND GENERAL INDUSTRY

Gardner-Denver Company, Quincy, Illinois
In Canada: Gardner-Denver Company (Canada) Ltd., 14 Curity Avenue, Toronto 16, Ontario

Above Rear-Dump handles 53% of limestone haul for Allegheny Mineral Corp.

The LeTourneau-Westinghouse machines you see here — a 186 hp Tournatractor and an 18-ton Rear-Dump — have been used by Allegheny Mineral Corporation, Cowansville, Pennsylvania, since the summer of 1953 both for stripping and for hauling shot limestone. Units work alternately at Allegheny's pits in Parker's Landing and Kittanning. They make trips between the two places under their own power. The Rear-Dump drives the 35 miles through traffic in about an hour; Tournatractor makes the trip in about two hours. Fingertip electric power steer and 4-wheel air brakes (more braking surface on 1 wheel than most units have on all 4) make for safe high-speed travel.

Above Rear-Dump is being loaded by a 1½-yd. shovel. Loads in the shot limestone usually weigh out at around 19 tons each. Note simplicity of the Rear-Dump body design. Unit has no frame, no sub-frame, no springs or spring hangers, no front steering wheels, no hydraulics — hence seldom needs repairs.

Low entry from rear, plus big 9½' x 12' target, speed loading, also reduce spillage. Triple-layered all-steel body absorbs shocks of heavy, sharply-fragmented rock. High all-steel front guard protects driver, controls. Capacity of this Rear-Dump, without sideboards, is 18 tons. Other models carry 9, 35, and 50 tons.

Hauling shot limestone 4/10 mile from pit to crusher, Rear-Dump reaches 15 mph speeds, despite narrow roads, short sections of 10 to 15% grades and several sharp curves. Tires give adequate traction even on snow and ice. Material being hauled will be crushed into agricultural limestone and road-surfacing.

Waste material is dumped about half a mile from the shovel. Company records show Rear-Dump averages 34 loads per 8-hour shift — as much as the shovel can load. Note how body swings below and behind rear wheels. This keeps material from piling under unit, also allows safe dump over steep banks.

Spoil dumped by the LeTourneau-Westinghouse Rear-Dump and another hauler is leveled by Tournatractor. Other duties for this 19 mph tractor include leveling and maintaining limestone aggregate stockpiles, pulling a 15-yd. scraper to self-load and strip dirt and rock, and pulling a ripper to loosen rocky material.

Tournatractor blade carries 2½ cu. yds. per push. Electric-control down-pressure provides smooth cut. Tires roll without damage over abrasive footing which badly damages crawler tracks. Says Co-Owner C. H. Snyder, "LeTourneau-Westinghouse units just fit our layout. Their maintenance is low and production high."

Tournatractor—Trademark TR-662-Q-b

For more information on either Rear-Dump or Tournatractor, please write or call:

LeTourneau-Westinghouse Company

PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

A report from a Canadian gypsum Company

on their 6 new high-speed haulers and tractors

Wide bowl opening on Rear-Dump provides easy target for dragline loading. Model shown has 19-ton capacity . . . newest "C's" carry 22 tons.

Smooth, streamlined, unobstructed body readily sheds sticky material.

Haul to overburden dump is made at speeds up to 35 mph.

High-speed mining tools by LeTourneau-Westinghouse

REAR-DUMPS

9 ton, **138** hp
22 ton, **208** hp
35 ton, **293** hp
50 ton, **420** hp

BOTTOM-DUMPS

18 yard, **208** hp

SELF-PROPELLED SCRAPERS

7 yard, **138** hp
16 yard, **208** hp
23 yard, **293** hp

Rear-Dumps, Bottom-Dumps and Scrapers all interchangeable behind same prime-mover.

RUBBER-TIRED TRACTORS

Now available—**208** hp

A leading Canadian gypsum Company must take all their gypsum from under a 30 to 75 ft. layer of clay-pocketed rock. This sticky overburden is loaded by draglines, and hauled half a mile to waste dumps. Six LeTourneau-Westinghouse units are used to speed hauling and dozing on the big job. Here is what they report about these machines.

Advantages of Tournapulls

Two original Tournapull Rear-Dumps were purchased to haul overburden following years of satisfactory experience with bottom-dump Tournatrailers. These two 18-ton rear-dumps performed so well, the company recently bought 2 more.

1 Company officials give, as chief advantage, the ability of the Tournapull Rear-Dumps to go through mud which stops all other haulers. Tournapulls even work out of deep mud-holes and off dumps so soft a man cannot walk through them. This exceptional mud-ability is due partly to traction of big single 21.00 x 25 low-pressure tires . . . partly to power steer which works independently of footing through geared kingpin . . . partly to exclusive patented differential which *automatically* transfers power from slipping wheel to wheel on better footing.

2 Tournapull Rear-Dumps haul faster than ordinary trucks on the rough roads. Rig's big tires cushion the bumps, let Tournapulls often reach top speeds.

3 Tournapull Rear-Dumps work faster in narrow quarters. They turn around normally in a space 24 ft. wide . . . with bowl raised (which shortens wheelbase) they turn around non-stop in a space only 21 ft. wide. This mobility

A Subsidiary of Westinghouse Air Brake Company

Tournatractor low-pressure tires provide plenty of flotation and traction in loose steep-grade footing. Multi-disc 4-wheel air brakes give ample margin of safety.

speeds haul on narrow roads, reduces time for spotting turn at both shovel and dump.

4 Tournapull Rear-Dumps need practically no clean-up aid on the dump. With front-wheel drive, they back safely to edge of bank. Bowl swings behind and below rear wheels . . . loads fall free over the edge. Company officials say only one clean-up is now needed *per day*.

Advantages of Tournatractors

Company owns 2 of these giant 4-wheel tractors. Each is equipped with dozer blade, does such work as leveling tailings pile, cleaning overburden dump, maintaining stockpiles, plowing snow.

1 Canadian gypsum officials say Tournatractors chief advantage is their ability to go anywhere . . . over rough ground, pavement, railroad tracks. Tires do no damage to surface, or surface to tires. Mobility pays off especially on such scattered jobs as removing newly-shot rock from rail tracks. Fast removal is important here, since gypsum is carried to crushers and screening plant by railroad ore cars.

2 Speed often enables each Tournatractor to do as much work as 2 crawler-tractors. Tournatractors doze faster, 3 to 8 mph, compared to crawlers' 1 to 4 mph . . . they back up faster, 3 to 8 mph vs. crawlers' 1 to 3 mph . . . they move faster between jobs, 19 mph vs. 4 to 8 mph for track machines.

3 Tournatractors reduce maintenance needs. Because 4 rubber-tired wheels do work of the 500 to 600 parts of a track assembly, there are less places to grease and oil, fewer parts to wear out.

Ask us to show you first-hand how these advantages can pay off for you.

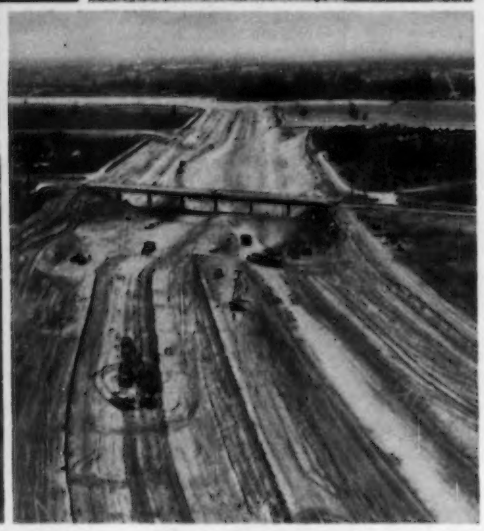
Tournapull—Trademark Reg. U.S. Pat. Off.
Tournatractor—Trademark TR-750-M

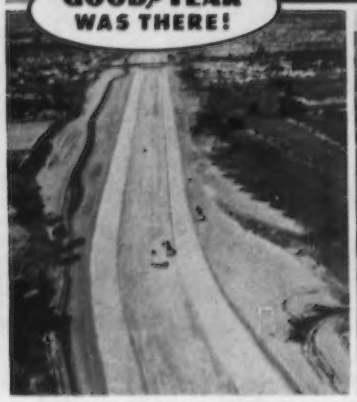
Dozing rock, Tournatractor moves up to 2½ cubic yards per pass.

LeTourneau-Westinghouse Company

PEORIA, ILLINOIS

3 GENERATIONS BUILD WEST COAST CONSTRUCTION EMPIRE





Starting 76 years ago, as a small contractor, Adolph Teichert built the versatile organization that has what it takes to lick the big ones pictured above. Today, when you see a giant West Coast job—quarrying, earth-moving, road, rail bed, military base or dam building—it's a fair bet that A. Teichert & Son, Inc., have a hand in it! Earthmover shown above has Goodyear Hard Rock Rib tires on front wheels, Hard Rock Lug on rear.

Longest-lived tires in any generation are built with 3-T NYLON CORD!

A GOODYEAR EXCLUSIVE, 3-T NYLON CORD can *obsolete* your present tire-cost calculations. It makes Goodyear tires so durable that bruise-breaks and heat-blowouts are close to the vanishing point. Ply separation and flex failure have also been virtually eliminated—keeping bodies in shape for many more re-lugs and recaps. In fact, 3-T NYLON CORD has ADDED so much to Goodyear tire life—and SUBTRACTED so much from operating costs—that it's simply good business to try Goodyear 3-T Nylons on your toughest operations!

Goodyear Truck Tire Dept., Akron 16, Ohio

Look for this sign; there's a Goodyear Dealer near you.

FOR EACH JOB, THERE'S A COST-CUTTING GOODYEAR TIRE BUILT WITH 3-T NYLON CORD

GOODYEAR

MORE TONS ARE HAULED ON GOODYEAR TRUCK TIRES THAN ON ANY OTHER KIND

Road Lug, Sure-Grip, All-Weather—T. M.'s The Goodyear Tire & Rubber Company, Akron, Ohio

PEORIA, ILLINOIS

A ***BARGAIN***

THAT BY-PASSES THE DISTRIBUTOR

IS NO BARGAIN AT ALL!

In these times of mounting production costs, many purchasers of industrial supplies and materials are beginning to look upon their distributors as an extra expense. At first blush, it might *seem* cheaper to buy direct from the maker.

Actually, the distributor helps *both* the buyer and manufacturer save money. Like this:

He saves the buyer warehousing, handling and storage details, paperwork, provides an immediate single source of supply for thousands of items that industry needs, often in a hurry.

He saves the manufacturer the cost of heavy inventory maintenance in all parts of the country, the expense of an army of salesmen, a fleet of trains and trucks, and a staff of credit and collection experts. In a sense, your distributor represents a cooperative distribution facility that you share with all other firms in your area.

Next time you're tempted to get a direct quotation from the manufacturer, whether on a big or small item, figure out *all* the costs—not just the first cost—and you'll find you gain much more, yet in the long run pay no more, by utilizing the services of your distributor.

WICKWIRE ROPE

3151

A PRODUCT OF THE COLORADO FUEL AND IRON CORPORATION

Largest Copper Producer in the Far East Treats 4000 t.p.d. with 100% Cyanamid Reagent Combination

As the new Toledo Copper Project of Atlas Consolidated Mining and Development Corporation swings into full-scale production, a major step in rebuilding the Philippine Mining Industry will have been taken.

With a capacity of 4000 t.p.d. the new Toledo mill will be by far the largest copper producer in the Far East. At peak production the mill will produce 200 t.p.d. of copper concentrates assaying 24% Cu.

For the preliminary copper float AEROFLOAT® 238 Promoter and AEROFROTH® 80 Frother are used to produce a high-grade concentrate running 26% Cu. A bulk float follows, using a reagent combination composed of AEROFLOAT® 25 Promoter, AERO* Xanthate 301, AERO* Promoter 404 and AEROFROTH® 80 Frother. Bulk concentrates are then reground and refloated to produce a second copper concentrate and the pyrite product. In the selective flotation circuit, reagents include AERO® Brand Cyanide, AEROFLOAT® 238 Promoter, AEROFROTH® 80 Frother and lime.

Combined copper concentrates containing over 92% of the total copper in the feed are presently being shipped to Japan for smelting. Recovery of molybdenite from the copper concentrate is now under study, and work is also underway to expand plant capacity to 6000 t.p.d.

In the development of treatment methods for Toledo ore, Cyanamid Engineers have been privileged to work closely with A. Soriano y Cia., General Managers and Consultants for Atlas Consolidated. We will welcome the opportunity to work with you on your beneficiation problems and to provide your reagent needs from Cyanamid's complete line of metallurgical chemicals.

*Trade Mark

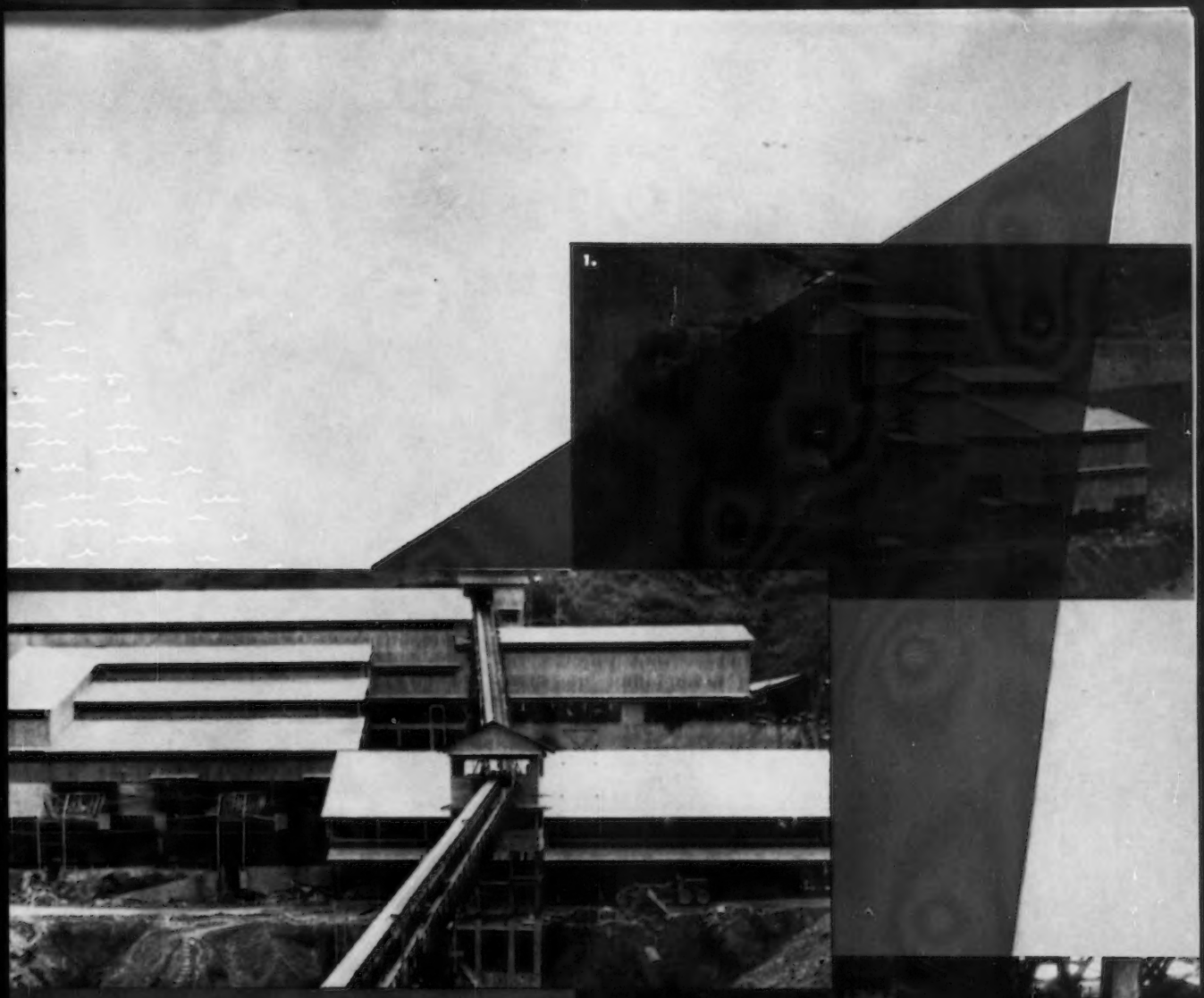
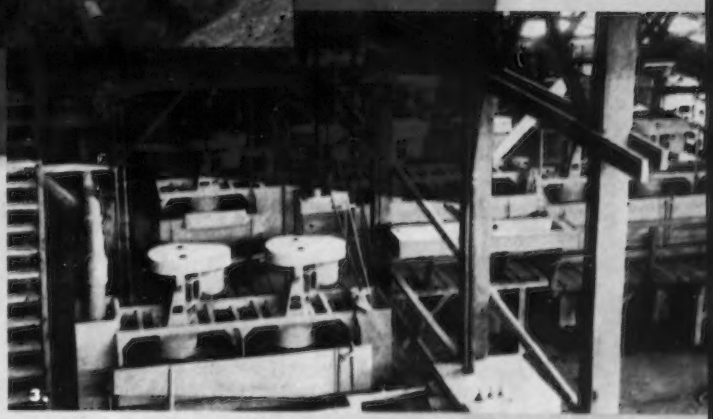


PHOTO 1.
Crushing plant at entrance to open pit mining operation on the north side of the Rag River, Lutopan, Toledo on the island of Cebu, P.I. Crushing is in two stages to 5/8". Crushed ore is conveyed across the river to the grinding and flotation plant.

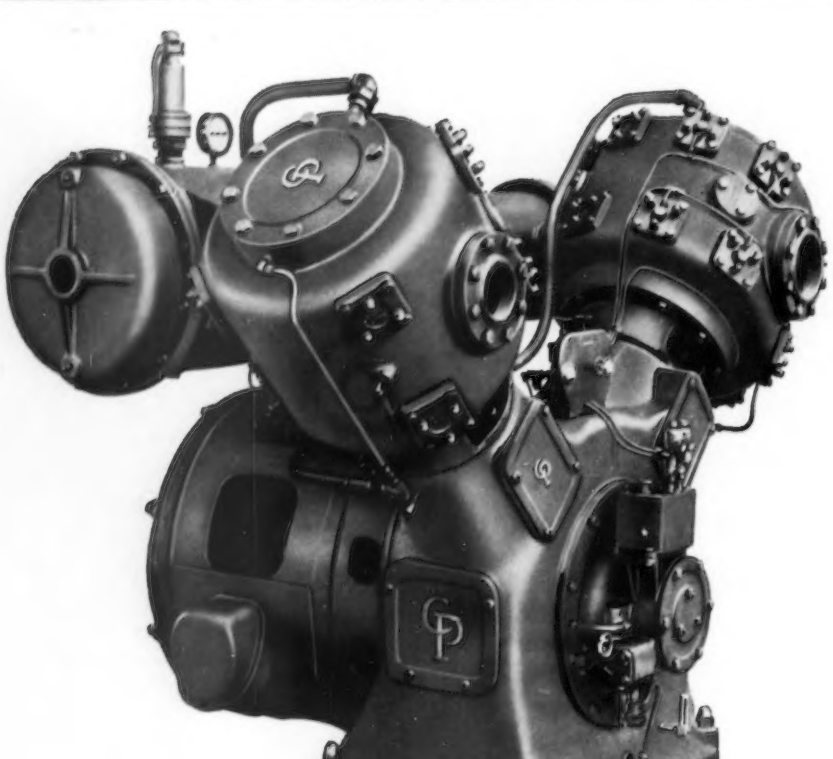
PHOTO 2.
Grinding of Toledo ore is also in two stages. The first stage employs 8' x 6' ball mills in closed circuit with rake classifiers. The second stage includes 20" cyclones, 6' x 10' ball mills and bowl classifiers.

PHOTO 3.
Interior of Toledo mill showing Japanese-built 56" flotation machines in the roughing circuit. Much of the mill equipment was salvaged from pre-war Philippine mills and rebuilt.



AMERICAN *Cyanamid* COMPANY

MINERAL DRESSING DEPARTMENT — 30 ROCKEFELLER PLAZA, NEW YORK 20, NEW YORK



for the most in a Compressor

IN THE LEAST SPACE

The Class "Y" compressor offers everything a good compressor should have for heavy duty service: high overall efficiency, long life with minimum maintenance; smooth, quiet operation, accessibility and simplicity, compactness and ease of installation. With one-piece frame, it is shipped intact, including a flange-mounted motor—truly a "package" type unit. Built in sizes 75 to 250 H.P., it is available in single and multi-stage designs for pressures up to 5000 pounds, with belted, coupled or flange-mounted motor drive.

Simplate Valves, efficient and easy-to-clean shell-and-tube intercooler, multistep capacity regulation, roller main and precision type connecting rod bearings are some of the reasons for the big compressor performance of these medium size machines.

Write for Bulletin 766

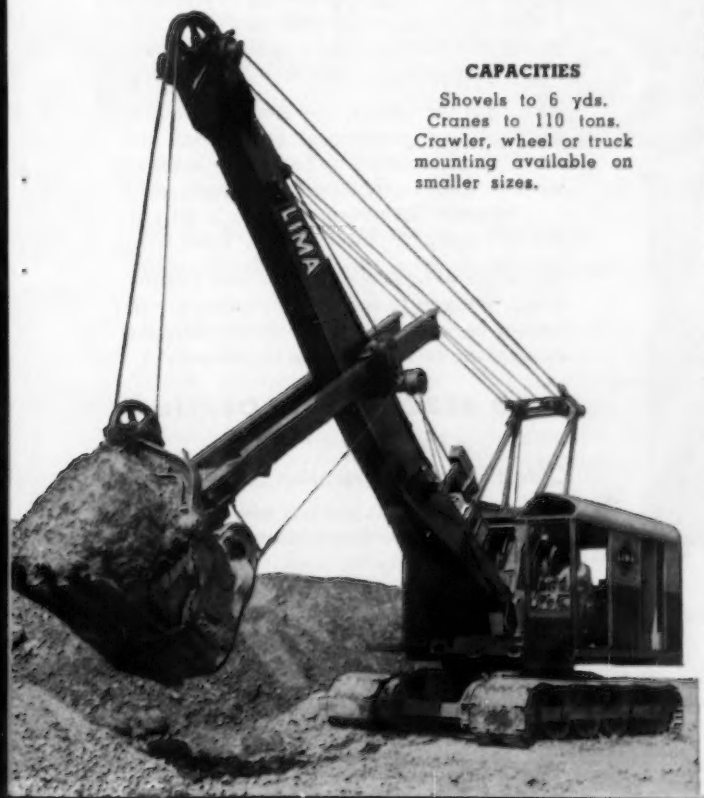
Chicago Pneumatic *8 East 44th Street, New York 17, N. Y.*

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES • ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

LIMA'S new Electric Power Unit eliminates stalls, won't burn out

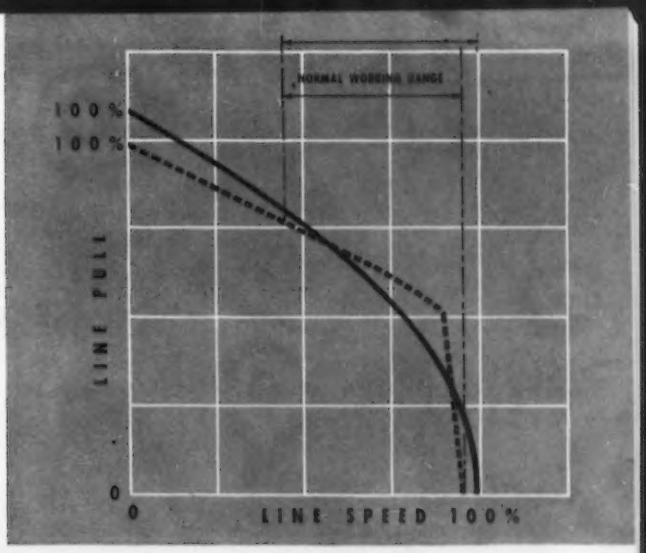
LIMA's new optional power unit matches, *electrically*, diesel-torque converter performance. It combines an AC motor with a single stage torque converter to adapt actual power output to work load demand—at constant motor speed. Thus, you get power on demand through a wide operating range . . . and the motor will not stall or burn out in heavy load operation.

Just check the performance curves —— They make it clear that LIMA's new electric power unit is the perfect answer when your job calls for electrically powered machines. The new unit is available on every LIMA machine. It will pay you to get the full story today from your nearby LIMA distributor . . . or write: Construction Equipment Division, Baldwin-Lima-Hamilton Corporation, Lima, Ohio.



CAPACITIES

Shovels to 6 yds.
Cranes to 110 tons.
Crawler, wheel or truck mounting available on smaller sizes.

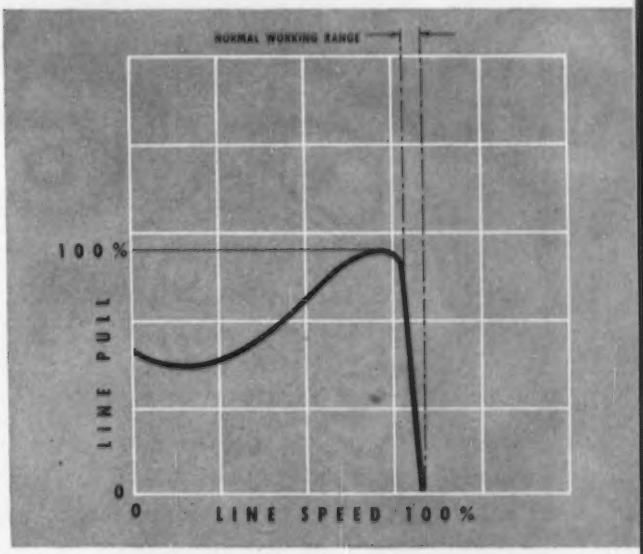


Power Performance of LIMA'S New Optional Unit:

A.C. Electric motor with torque converter drive [Diesel-torque converter curve (dotted line) shown for comparison]

With this drive, even under extreme loading, the motor will pull down in speed only a very small amount. It can never be stalled.

The line pull will constantly increase through a long pull down speed range, depending upon the load applied.



Power Performance: A.C. Electric motor with direct drive

The motor speed and torque varies as shown for line speed and pull.

With a pull down in speed of only 3% to 5%, torque rises too fast. The motor will stall quickly after peak torque is reached. Workable speed range is small, stalls are frequent.

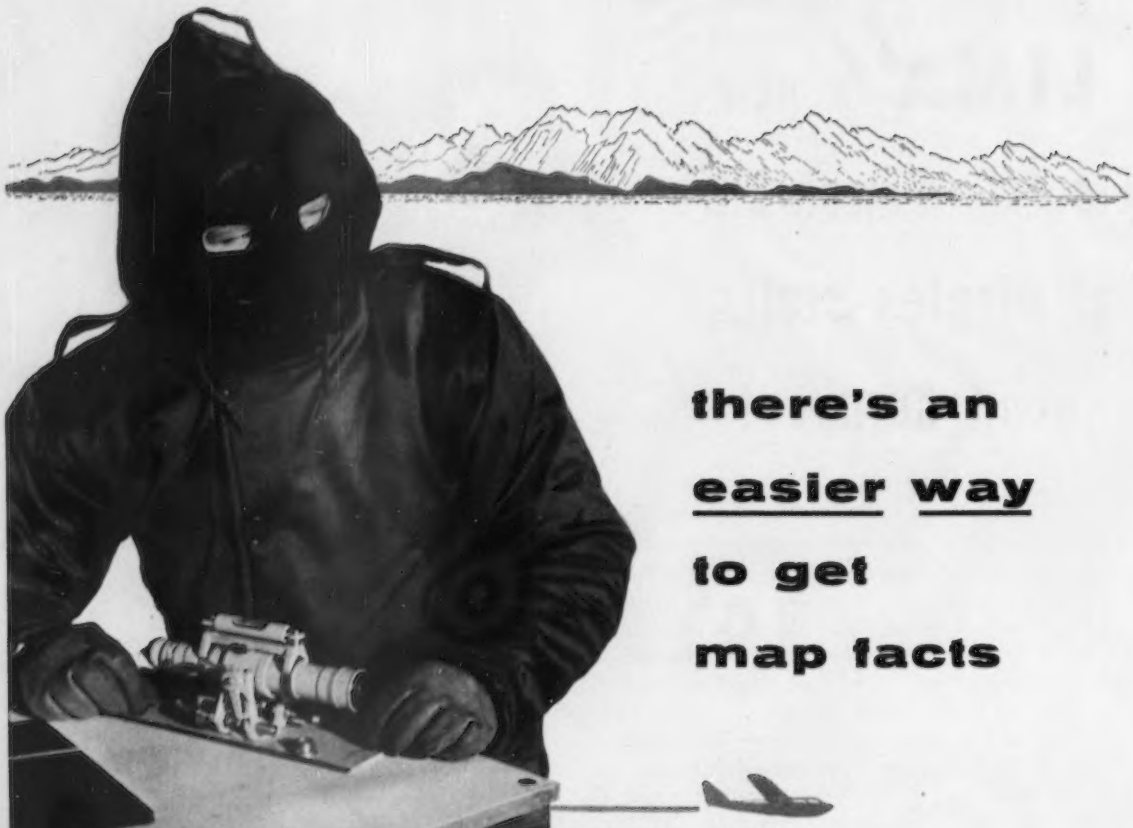
BALDWIN BLH LIMA-HAMILTON

LIMA SHOVELS · CRANES
DRAGLINES · PULLSHOVELS

BALDWIN-LIMA-HAMILTON

Construction Equipment Division · LIMA · OHIO · U. S. A.

DISTRIBUTORS IN PRINCIPAL CITIES OF THE WORLD



there's an easier way to get map facts

Severe weather and formidable terrain can make ground surveys slow, hazardous and expensive. On any survey—in any season, anywhere in the world—you can save time, money and trouble by turning the job over to AERO, pioneer and leader in aerial mapping.

AERO has the planes, the modern mapping and airborne geophysical equipment, and the skilled specialists to do the job better—whether it be exploration for minerals or oil . . . resources inventories . . . maps for railroads, highways, power lines or town sites.

In the planning stages of your next project, it will pay you to call in our engineers, who have a background of over 2,000,000 miles of mapping and exploration experience.

AERO SERVICE CORPORATION

PHILADELPHIA 20, PENNSYLVANIA

Oldest Flying Corporation in the World

Offices also in TULSA, SALT LAKE CITY, DULUTH
In Canada: CANADIAN AERO SERVICE, LIMITED—OTTAWA

Winter ground survey, Northwest Canada

AIRBORNE MAGNETOMETER SURVEYS · SCINTILLATION COUNTER SURVEYS · PRECISE AERIAL MOSAICS
TOPOGRAPHIC MAPS · PLANIMETRIC MAPS · RELIEF MODELS · SHORAN MAPPING

INTRODUCING

a new, important advance in horizontal vibrating screens

Here are all the benefits of horizontal screening— plus minimum height, greatly simplified maintenance

Completely new in design and performance, this horizontal screen has two vibrators, one mounted on each side of the screen for easy access and servicing. The vibrators do not project above sideplates, therefore headroom is held to a minimum. Center-of-gravity location of vibrator assures uniform straightline vibration.

For dewatering, conveying, feeding—Link-Belt Straightline vibrating screens assure maximum capacity for the size of screen cloth. Call your nearest Link-Belt office for full details.

Link-Belt Straightline vibrating screen at Elk Creek Coal Co., Emmett, W. Va., dewaters about 3,000 GPM and 50 TPH of ¼" x 0" washed coal.

LINK-BELT

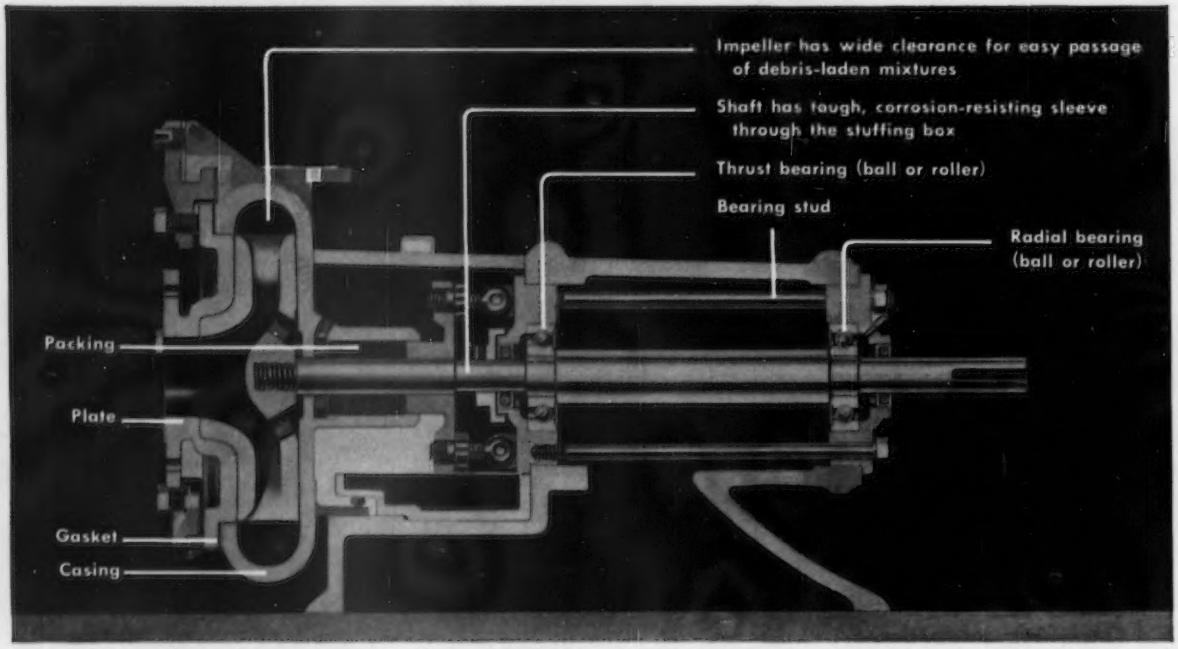
VIBRATING SCREENS

12,051

LINK-BELT COMPANY: Executive Offices, 307 N. Michigan Ave., Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World.

AMSCO® PUMPS

job-rated for grueling service



Compact design of Amsco Mining Pumps is shown here. There are only 3 parts (casing, impeller and end plate) exposed to the grinding flow of abrasive or erosive materials.

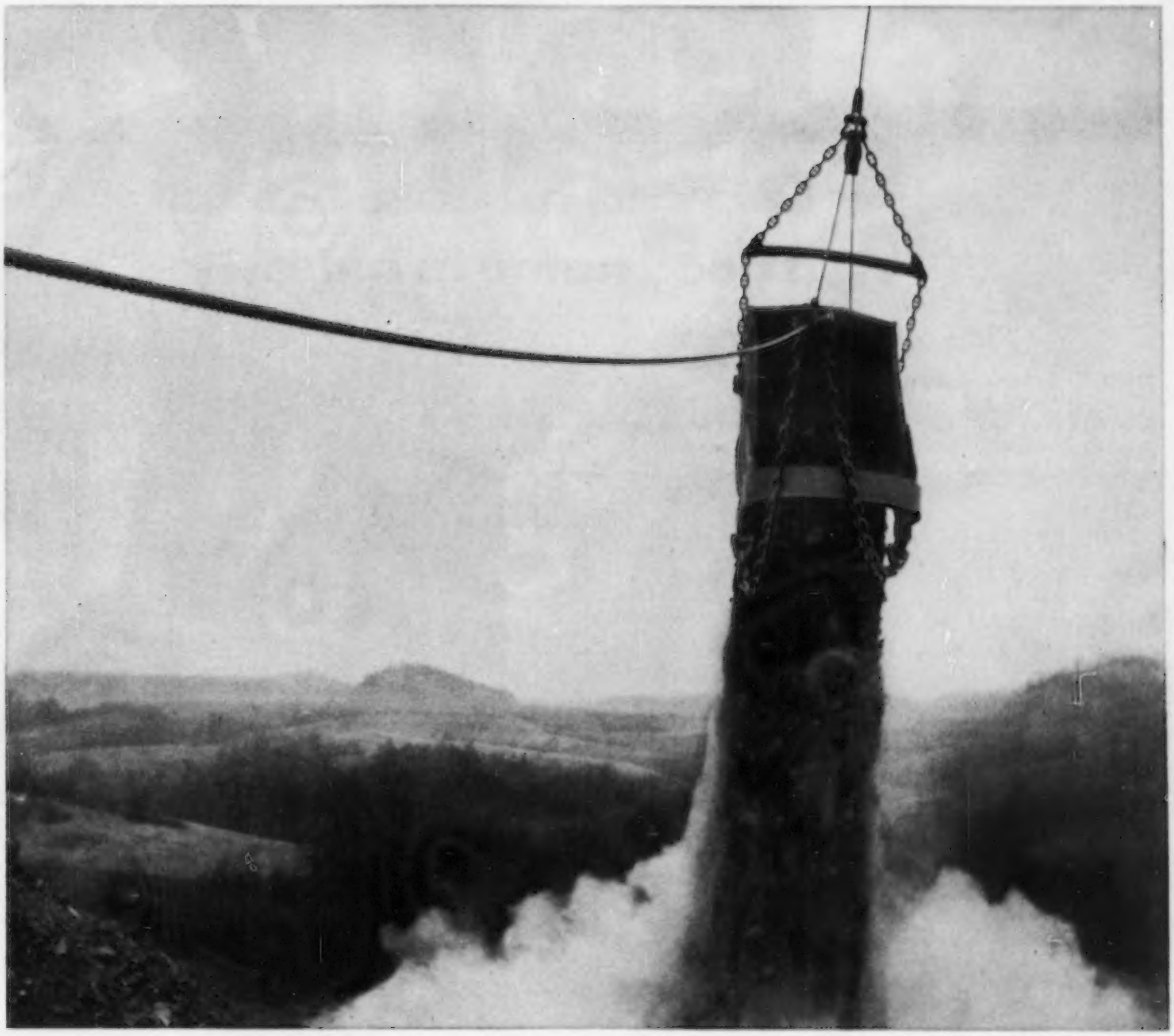
Amsco pumps stay on the job longer because they're designed especially to handle pump punishing materials such as abrasives or heavy solids.

Special wear-resistant metals are used in Amsco pump parts so they will stand up longer in abusive service. And, when repairs are needed, you'll save on labor costs because Amsco pumps are compactly designed. It takes fewer man-hours to disassemble and assemble Amsco pumps because of their simple design.

An Amsco pump specialist, with experience gained in many different installations, can help you analyze your operation and recommend the type of Amsco pump best suited for your application. Standard size Amsco pumps range from 6″ to 16″ discharge openings. Larger sizes are also available. Write for Bulletin No. 548IP which gives specifications and complete data on the Amsco pump line. Amsco also manufactures a complete line of hardfacing welding equipment...both rods and machines.

AMERICAN Brake Shoe COMPANY

AMERICAN MANGANESE STEEL DIVISION
Chicago Heights, Ill.



Here's where J&L Wire Rope cuts your costs

On the big rigs like this, wire rope is an important cost item. That's why so many big mining men look to J&L for Wire Rope that fits their equipment requirements . . . for the right combination of strength, flexibility and toughness to stay on the job.

They've found the quality of J&L Wire Rope is reflected on the profit sheet in terms of minimum downtime for re-rigging, lower rope costs and more tons mined per wire rope dollar.

J&L Wire Rope quality is the combination of more than 100 years of steelmaking experience, topflight wire rope engineering and the most modern production equipment. The result—every wire, every strand, every J&L Wire Rope is "precisionbilt" for maximum service.

No matter what equipment you're operating there's a J&L Wire Rope designed to give you cost-cutting service life. Write today for complete information on J&L Wire Ropes.

Jones & Laughlin

STEEL CORPORATION — *Pittsburgh*

J&L STEEL

Jones & Laughlin Steel Corporation
412 Gateway Center, Pittsburgh 30, Pa.

Please send me complete information on J&L Wire Ropes.
Please have your representative call.

Name_____

Title_____

Company_____

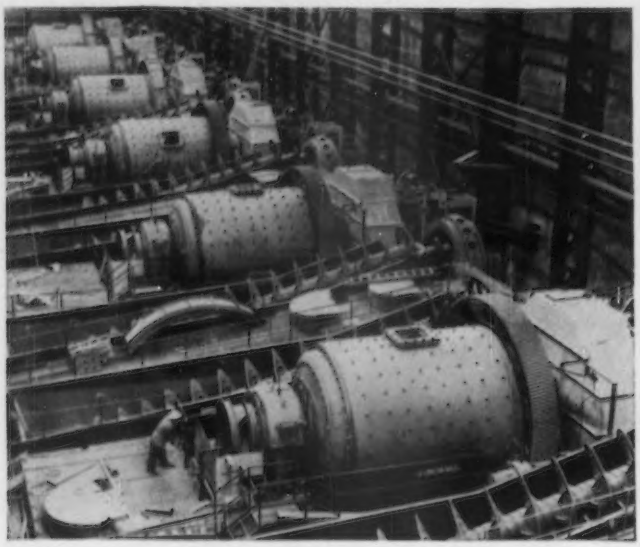
Address_____

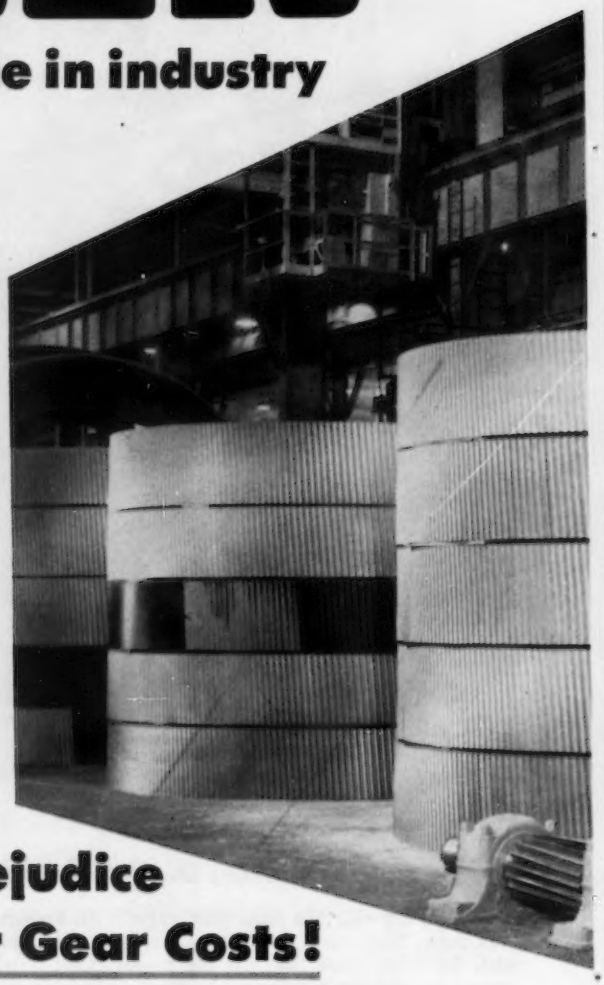
Gears by FALK

...a good name in industry

RIGHT: Single helical ring gears being prepared for shipment.

BELOW: Battery of six ball mills pulverizing copper ore. Mills are driven by 1250 hp motors through Falk single helical ring gears.





Falk's Freedom from Prejudice Can Cut Your Gear Costs!

It is false economy to use spur gears on applications which need modern helical gears. Further, it is a mistake to use a *double* (herringbone) helical where a *single* helical will serve more satisfactorily—or vice versa!

You'll find it *good business* to consult Falk—long-recognized leader in precision gear development—on your gear needs. For Falk is best equipped to recommend and produce the proper gear for any requirement—single or double helical, or spur—without prejudice! This freedom from bias is your assurance of getting the exact gear you need—and getting the maximum return from your gear investment.

Operators and engineers know that precision-cut Falk Helical Gears (with two or more helical-cut teeth sharing the load at every instant) last longer, are less subject to destructive damage from ever-present abrasives than gears of any other type. Helicals wear *in*, instead of wearing *out!* Because of their higher possible ratios, helical gears permit use of higher-speed motors.

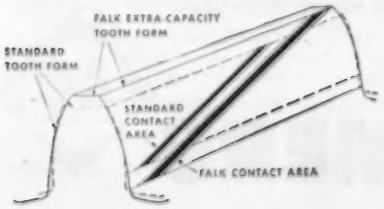
All this adds up to substantial savings: Your long-range gear costs are less because helicals last longer ...you save on maintenance, prime-mover costs, power bills and floor space. Because power transmission is smoother, driving and driven machinery performs better, has longer life.

Consult your nearest Falk representative for full information—or, if you prefer, write to us concerning your gear problems, plans and requirements.

THE FALK CORPORATION . . . 3001 W. CANAL ST., MILWAUKEE 8, WISCONSIN

GEAR FACTS FOR ENGINEERS

One factor determining gear rating is the amount of contact area (length and width) on teeth when engaged. With spur gears, the contact area is a narrow band, parallel with the axis of a single tooth. With helical gears, total contact area is the sum of the oblique contacts over the face of two or more teeth. Thus helical gears have substantially greater capacity than spur gears.



The Falk Helical Gears offer a special extra-capacity tooth form. The extra capacity is obtained by cutting deeper teeth that are broader at the base than ordinary helical tooth forms. This results in the larger contact area and stronger tooth shown in the sketch. Years of laboratory tests and thousands of actual field installations have proved conclusively that the exclusive tooth form of Falk single helical and herringbone gears provides substantially superior load-carrying capacity.

PROVED ON ONE OF THE

Toughest Testing Grounds

...THE MESABI RANGE

New **Run-of-Mine SCALPING SCREEN**

Single pieces weighing as much as four tons . . . hundreds of pounds of sticky material adhering to screen body . . . large volume requirements. These are the demanding conditions under which this screen is setting new performance standards.

Here are some of the many features which enable this screen to meet severe duty with *minimum maintenance:*

Extra-Large Bearings (largest ever installed in an A-C screen) withstand punishing loads. Bearing life is extended, replacement less frequent.

Simplified Two-Bearing Mechanism reduces maintenance time and cost.

Cartridge Mechanism can be pulled out after merely removing sheave and four bolts.

Sturdy Channel Construction features 12-inch I-beam deck support.

Soft Support Springs provide smooth, balanced operation. No need to remove adhering material. Practically no vibration transmitted to building.

For information on this extra-heavy-duty screen and other Allis-Chalmers screens applicable to your operation, see your A-C representative or write Allis-Chalmers, Milwaukee 1, Wisconsin.

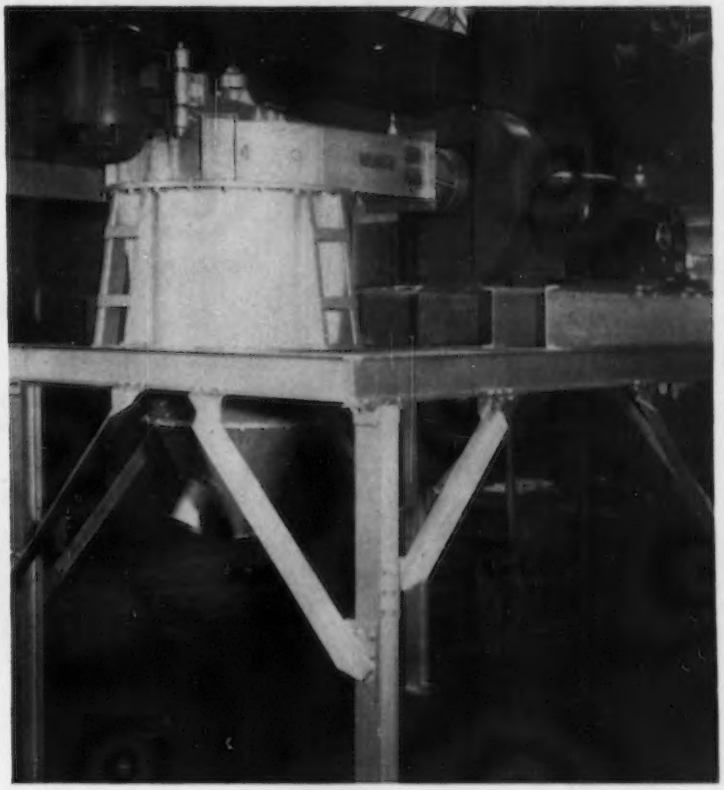
***Designed to Team Up With Primary Crushers* to handle the toughest job on any mining flow sheet.**

ALLIS-CHALMERS

A-4761

NEW TYPE STURTEVANT AIR SEPARATOR

Recovers Fines in Micron Ranges



Now the famous Sturtevant Whirlwind Air Separator, so widely used throughout industry for fast recovery of fines, has been specially designed to "pick-off" classified materials such as pigments, limestone fillers, plastics, oyster shells, etc., in micron sizes.

These highly efficient air separators select a continuously uniform product of desired fineness. Used in a closed circuit with grinding mills, they increase production, cut power costs.

Large feed opening, rugged construction, ease of adjustment, low power consumption assure economy of operation and minimum upkeep. Write for further information.

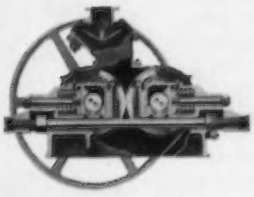
STURTEVANT
MILL COMPANY
101 CLAYTON STREET
BOSTON 22, MASS.

Designers and Manufacturers of:
CRUSHERS • GRINDERS • SEPARATORS
CONVEYORS • MECHANICAL DENS and
EXCAVATORS • ELEVATORS • MIXERS

OTHER STURTEVANT EQUIPMENT

MICRONIZER® GRINDING MACHINE
A fluid jet grinding machine, the Sturtevant Micronizer speeds reduction of materials to low micron sizes. These jet mills are especially applicable in fields where a particle size in microns is desired.
Sturtevant Micronizer grinding machines are available in many sizes and capacities.

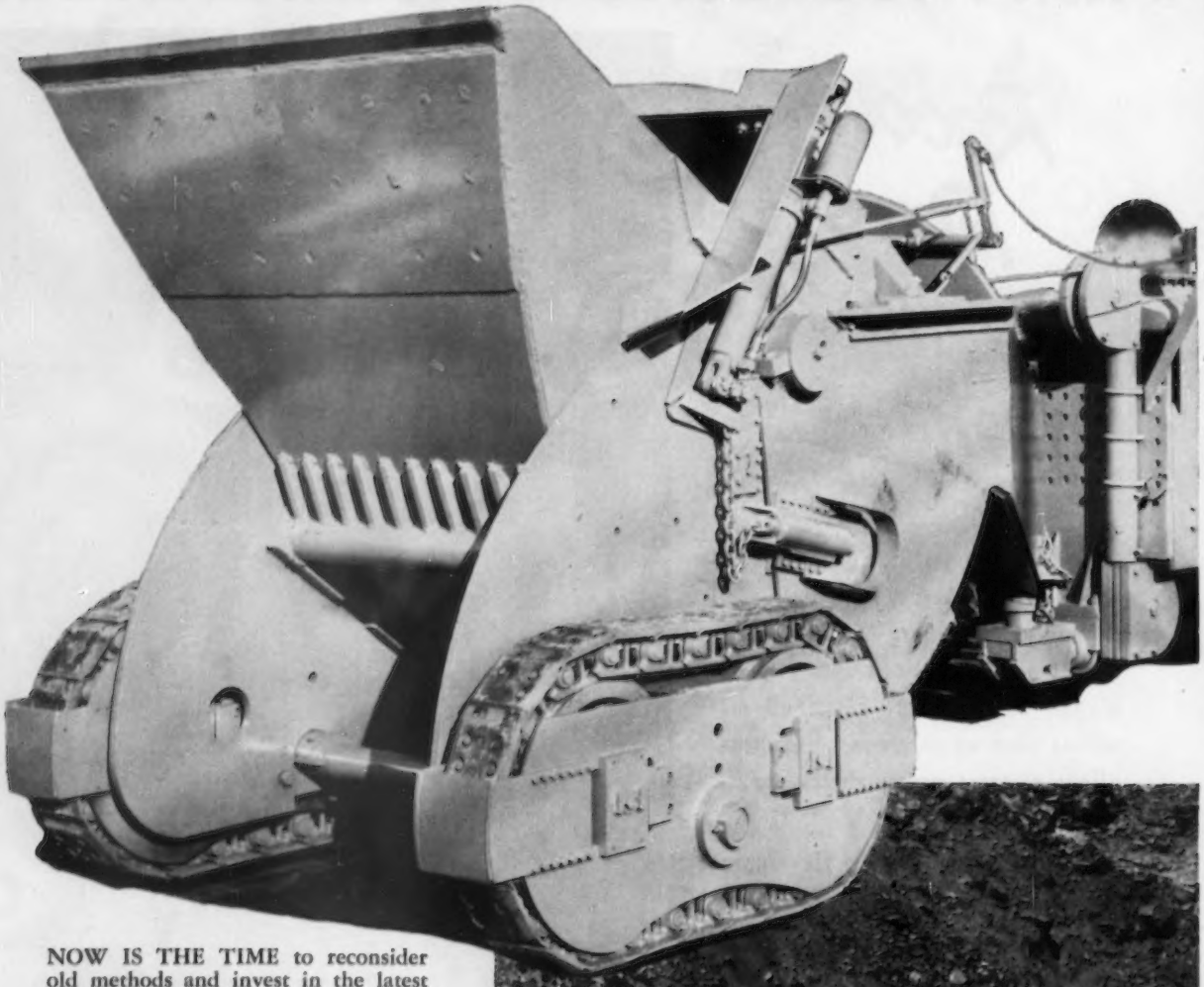
RING-ROLL MILLS
For medium and fine reduction (10 to 200 mesh), hard or soft materials. Very durable, small power. Operate in closed circuit with Screen or Air Separator. Open door accessibility. Many sizes. No scrapers, plows, pushers, or shields.



CRUSHING ROLLS
For granulation, coarse or fine, hard or soft materials. Automatic adjustments. Crushing shocks balanced. For dry or wet reduction. Sizes 8 x 5 to 38 x 20. The standard for abrasives.

BLENDER
Four-way mixing action assures a thoroughly blended product. Open-door accessibility permits easy cleaning. Available in many mixing capacities for ¼-ton per hour and up.

SHOWDOWN WITH



NOW IS THE TIME to reconsider old methods and invest in the latest production equipment. Compare the Gismo Method with other methods of mining. Compare initial investment required by conventional equipment and the Gismo equipment. Compare maintenance and operating costs of equipment in conventional methods with the equipment in the Gismo Method. Compare the total overall effect on your operation's efficiency between conventional methods and the Gismo Method. Some companies, who had plans already made for the purchase this year of equipment in conventional methods, have abandoned them in favor of equipment in the Gismo Method. They found upon investigation that the economies offered by the Gismo Method were far greater! That's why we urge you to investigate the Gismo Method.

THE GISMO does not load by momentum or crash-fashion. Shovel head is eased into muck pile (see photo at right) as simply as a hand shovel into sand. The Gismo loads regardless how thick the muck may be.

MINING COSTS: Gismo Method promises big new economies

Photo above, taken from operator's seat on tractor, shows how the GISMO is operated under his complete control with clear view of shovel.

THE GISMO MAKES POSSIBLE a mining method requiring few machines, few men, less planning and integration. It permits total mechanization of your mine—the solution to present economic conditions of high man-hour and materials cost.

How does it do it? By offering you a general purpose utility self-loading transport (the GISMO) that is simple, versatile and built to take the punishment of rock excavation. It is well suited to almost all mining conditions. No special development facilities or conditions are usually required. It operates in sloping ore bodies with irregular outlines, as well as large or relatively small openings. It is easily maneuverable at maximum or minimum speed of the equipment.

With perhaps a few exceptions, the GISMO can be taken into any mine . . . disassembled easily and quickly if necessary.

Its versatility meets every requirement. It loads (mucks) in development or production . . . transports . . . drills (supports 2 to 5 jib mounted drills) . . . back fills . . . moves boulder rocks . . . makes its own roadways and cleans up completely.

The GISMO is an efficient machine that can load and transport up to 100 tons per hour with a 300 ft. haul . . . drill at rate of 400 ft. per man shift . . . is an extremely simple piece of equipment built for rough work and requiring little maintenance. Its initial cost can be reasonable compared with one year's maintenance cost alone of much of the conventional equipment in present use. Without question, the extraordinary economies the Gismo Method promises merit thorough investigation by any firm excavating rock or its equivalent. Ask us for complete information. *Sanford-Day Iron Works, Inc., P. O. Box 1511 . . . Telephone 3-4191, Knoxville, Tennessee.*

Sanford-Day IRON WORKS

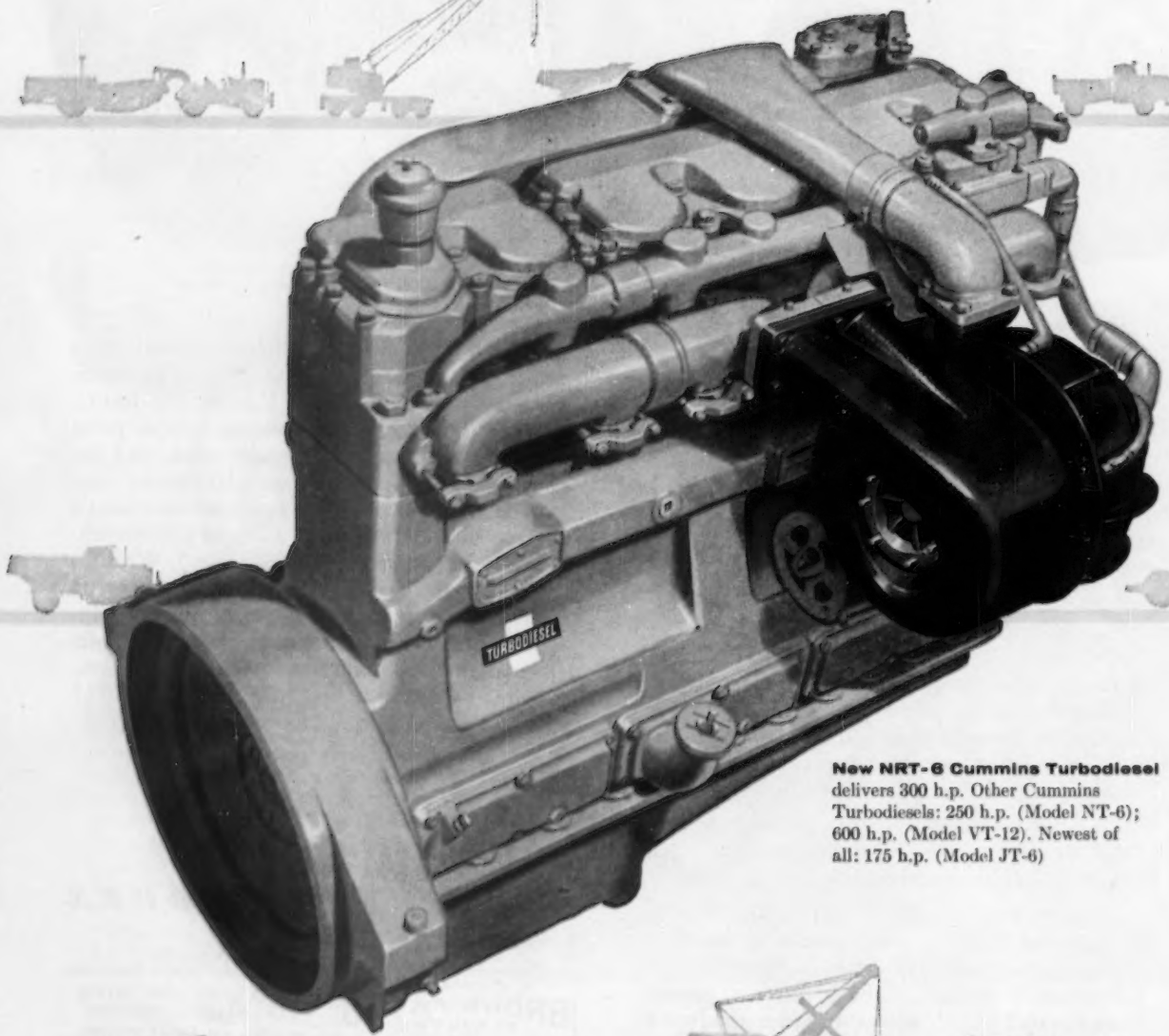
KNOXVILLE • TENNESSEE

AND BROWN-FAYRO DIVISION

MINE CARS, All Types - PRECISION WHEELS - "Brownie" HOISTS
CAR RETARDERS - SPOTTERS
PUMPS - OIL SPRAY SYSTEMS

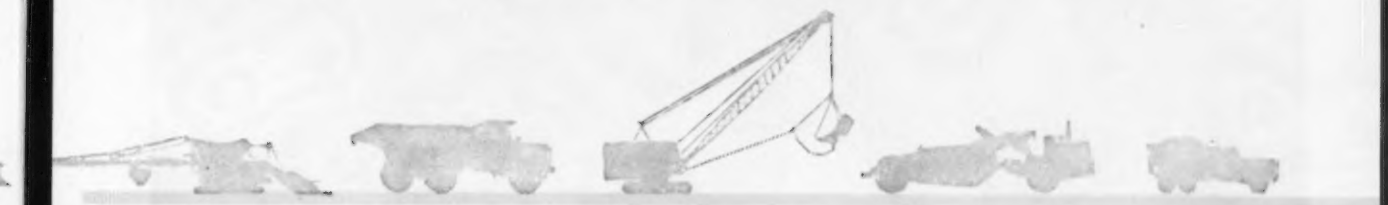
Now available in all kinds of mining equipment...

NEW CUMMINS



New NRT-6 Cummins Turbodiesel delivers 300 h.p. Other Cummins Turbodiesels: 250 h.p. (Model NT-6); 600 h.p. (Model VT-12). Newest of all: 175 h.p. (Model JT-6)

TURBODIESELS



POWER!.....PERFORMANCE!.....PROFIT!

Here's a new power concept to make *your* mining jobs more profitable. Cummins Turbocharging brings you extra diesel horsepower without added engine weight by harnessing the energy in normally wasted exhaust gases . . . boosting engine efficiency.

Field tests on all kinds of mining and construction jobs show significant savings in time, fuel and equipment. And like all Cummins Diesels, the new Turbodiesels feature the simple to understand and service PT fuel system and easy-as-gasoline maintenance. Added time-saving economy feature: Cummins nationwide distributor system makes sure that factory-type service and genuine Cummins parts are always near *your* operation.

No wonder *more and more mining men are standardizing on Cummins Diesels.*

CUMMINS diesels give you the big plus **MORE PROFIT**

Cummins Engine Company, Inc.
Columbus, Indiana

I am interested in finding out more about the advantages of Cummins Turbodiesels. Please send me:

_____Your directory of manufacturers offering Cummins Diesels in their equipment.

_____Your booklet illustrating Turbodiesel principles.

I am interested in converting my present equipment to Turbodiesel power.

_____Please have your representative call.

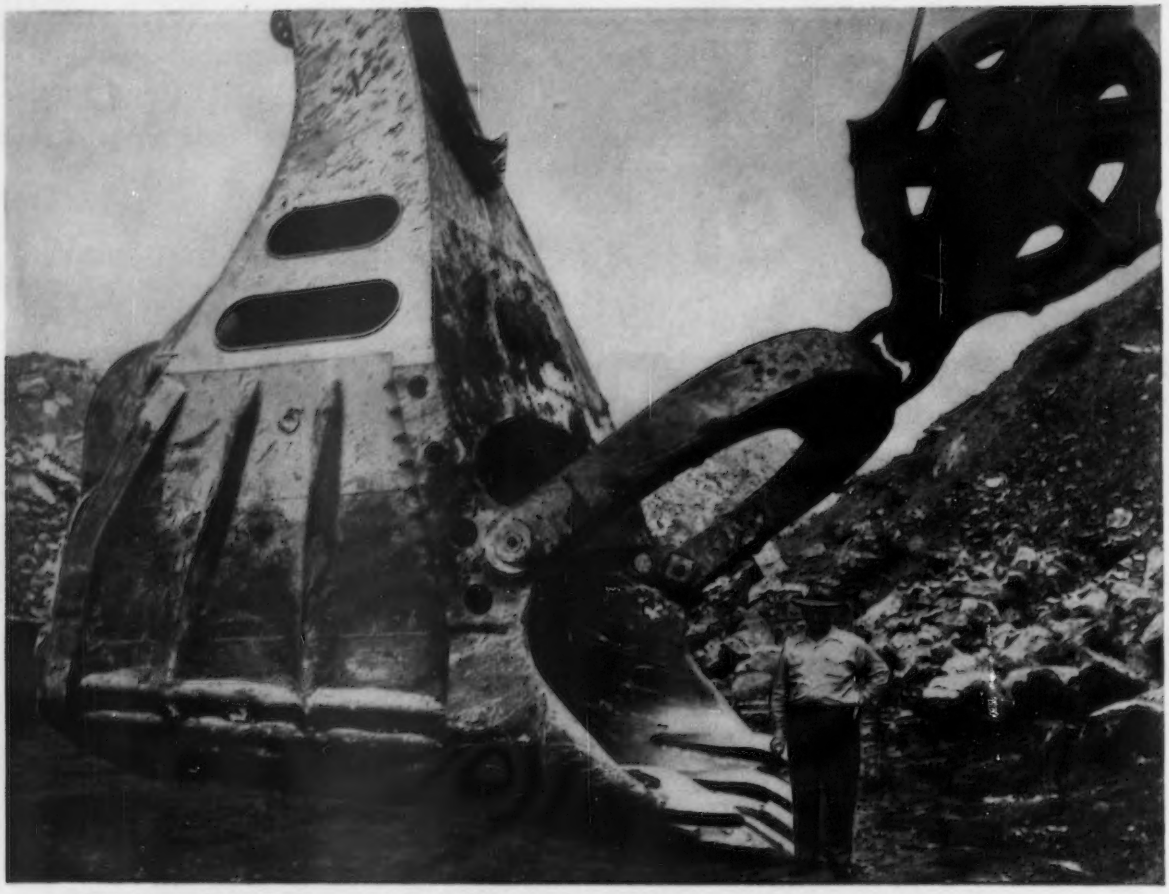
Name_____

Position_____

Company_____

City_____ State_____

EM-7



28% More Payload is carried by this 45 cubic yard "T-1" steel dipper which replaced a 35 cubic yard bucket of heavy castings. Use of "T-1" steel varies . . . from power shovels on the Mesabi Range, where temperatures drop to -50°F., to machine parts needing high strength at temperatures up to 900°F.

It's *lighter* than you think

it's made of the new nickel containing "T-1" alloy steel

THIS 45 CUBIC YARD POWER SHOVEL BUCKET shows the economy of using "T-1" steel. For here is a bucket of record size capacity, yet light enough to replace the shovel's original 35 yard dipper . . .

And after moving more than 30,000,000 tons of rock and earth, it's still going strong on the dipper stick of the world's largest shovel.

Such performance demonstrates how "T-1" steel resists both abrasion and impact.

USS "T-1" steel offers you three times the yield strength of plain carbon structural steel. Plus exceptional toughness even at sub-zero temperatures . . . particularly important to mine operators in Northern latitudes.

The properties of "T-1" steel permit you to reduce both size and weight of heavily stressed parts. Moreover, you can readily weld "T-1" steel without preheating or stress relieving. And the excellent corrosion resistance of this tough nickel containing alloy steel means increased equipment life.

"T-1" steel has proved itself in power shovels, bulldozers and mining machines. In mine cars, steel mill ladles, high speed rotating machinery and forging presses. Investigate how it may improve your products or equipment.

Get all the facts on USS "T-1" steel. Write to United States Steel Corporation, Pittsburgh 30, Pa.

INCO TRADE MARK

THE INTERNATIONAL NICKEL COMPANY, INC. 67 Wall Street New York 5, N. Y.

_____Please have your representative call.

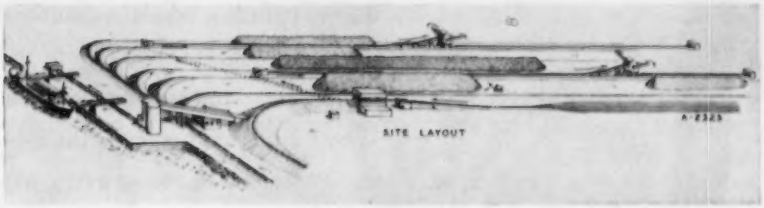
City_____

EM-7

CONVEYING LABRADOR IRON ORE-- 10,000,000 TONS ANNUAL CAPACITY

IRON ORE COMPANY OF CANADA— THE PORT OF SEVEN ISLANDS, QUEBEC

The S-A Conveying System provides for stockpiling or loading at dockside. Here, the traveling stacker is building a stockpile at the rate of 3750 net tons per hour. Conveyor booms stockpile to either side.



After crushing S-A Amsco Feeders carry the ore to these 60" belt conveyors which feed the ship loading boom belts.

At the docks, twin boom belts on traveling bridges with a combined capacity of 10,000 net tons per hour can load even the largest ocean-going ore ships in about 5 hours. Booms pivot up or down to compensate for tide or ship conditions.

• From the Port of Seven Islands, Quebec, 10,000,000 tons a year of Labrador iron ore will pour into America's industries. This feat of production must be done in the 150 to 160 days of good weather, during which ships can be loaded. An S-A Conveying System, handling an average of 70,000 tons of ore every day for loading and stockpiling, is helping make the job possible.

You may never need a conveying system as large or complex as the one at the Port of Seven Islands. But, whatever your bulk handling need, S-A engineers can show you an economical answer. Write for a free survey. No obligation, of course.

STEPHENS-ADAMSON MFG. CO.

4 Ridgeway Avenue, Aurora, Illinois

Los Angeles, Calif. • Belleville, Ontario

Engineering Division	Specialists in the design and manufacture of all types of bulk materials conveying systems.
Standard Products Division	A complete line of conveyor accessories including centrifugal loaders—car pullers—bin level controls—etc.
Sealmaster Division	A complete line of industrial ball bearing units available in both standard and special housings.

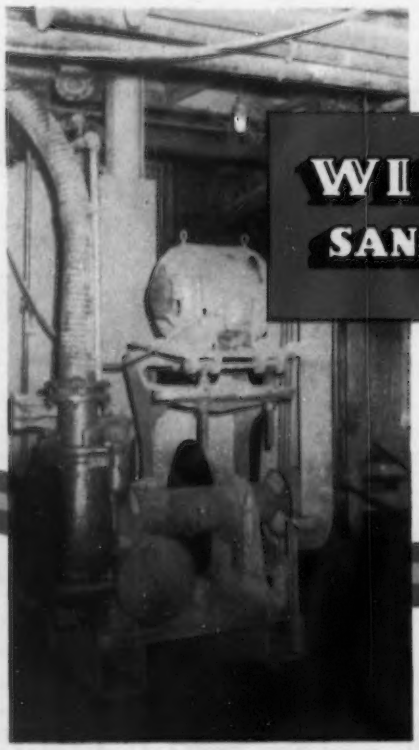
Pioneering in TACONITE

The future of American industry is closely allied with the economic processing of low-grade iron ore reserves in Minnesota and Michigan. Because of taconite's vital importance, industry is highly interested in the progress of the TACONITE PIONEERS.

Shown here is a typical example of how one taconite pioneer uses Wilfley Sand Pumps to help solve the problems encountered in handling flotation froth . . . proof again that on even the most difficult applications Wilfley Pumps meet every requirement.

Individual engineering on every application. Write, wire or phone for complete details.

Wilfley Acid Pump
"COMPANIONS IN ECONOMICAL OPERATION"
Wilfley Sand Pump



WILFLEY SAND PUMPS

A. R. WILFLEY and SONS, INC.
DENVER, COLORADO, U.S.A.
New York Office: 1775 Broadway, New York City

ENGINEERING AND MINING JOURNAL

JULY 1955

Mining's Stake in the New Minerals

TWO SIGNIFICANT NEWS ITEMS broke in mid-June: (1) American Zinc, Lead & Smelting Co. will participate with Utex Exploration Co., Combined Metals Reduction Co. and other investors in a $12.1-million uranium milling and mine development project at Moab, Utah. (2) Kennecott Copper Corp. and Molybdenum Corp. of America will develop tantalum-columbium ore deposits in a 7,900-acre optioned area at Oka, Quebec.

Such pronounced diversification patterns are increasing each year in the mining industry. Why? Here are two good reasons:

The approaching age of fission, fusion, jets and turbines is demanding hitherto little-sought minerals to provide atomic fuels, super high-strength and high-temperature alloys, super-light alloys, etc. Mining has a stake in this new trend in mineral development, but only if it puts some of its surplus back in the ground. With science moving forward at its present clip, who can predict which mineral or metal will spring into heavy demand next? It could be powdered magnesium or aluminum for high-temperature combustion, or lithium, or barite for shielding material. To make a profit, the industry must be poised to deliver these new goods. And who should know how to do it better than those who have been successful mineral and metal producers for years.

Diversification is the flywheel that can dampen the oscillations in the profit and loss sheet for a one-product enterprise when the metal price sags.

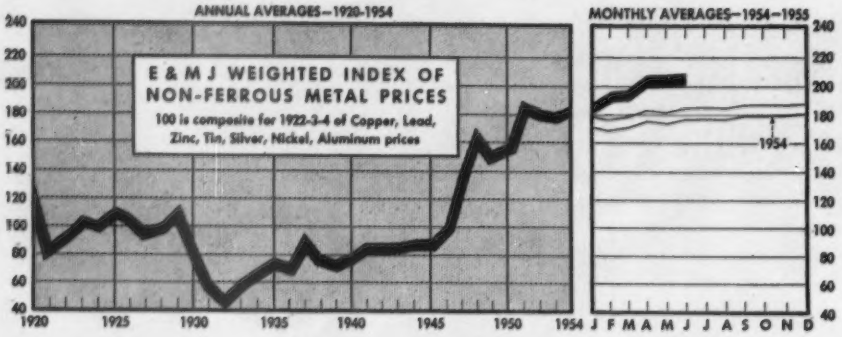
Breakers Ahead for the Industry

LAST YEAR the Scientific Manpower Commission disclosed that of 519,000 professional engineers reported in the 1950 census, about 5% were in mining and metallurgy. Of the engineering students in the class of 1953 only 3.8% were in mining and metallurgy, or a scant 900 students out of 24,189. This percentage dropped to 3.1% in 1954, 2.3% in 1955, 1.6% in 1956 and is now headed for a cellar position of an estimated 1.2% for 1958.

With technological problems increasing, and mining and metallurgical student enrollment dropping, percentagewise, the mining industry appears to be in for some real rough going. If we do a thoroughly sincere job of convincing high school graduates that the mining industry can offer attractive jobs for industrious engineers, at competitive salaries with other industries, the earliest relief we can look for is 1960!

E&MJ OUTLOOK

PRICES



MARKETS

Higher prices for zinc, tin and foreign silver during June pushed *E&MJ's* index up from 208.08 in May to 208.86 in June, a new high.

Despite steady high-level copper output, consumer demand is outstripping it to the point that premium prices are being paid in the "dealer" market.

Talk has virtually evaporated about a mysterious new use for quicksilver. Since Jan. 1, the price has dropped $44 per flask.

Chrome ore (Turkish) moved up on the strength of a barter between the U. S. authorities and Turkey involving a $15-million deal in wool.

●

LABOR

As dawn swept across the country on July 1, steel and copper industry strikes got off to a jittery start, with some non-ferrous workers jumping the gun according to union officials. By noon the same day steel settled for slightly more than a 15c package. Steel prices rose promptly $7.35 per ton.

●

AT HOME

Typical of the consolidation trend in the uranium industry, Treasure Uranium and Resources, Inc., has been organized. It represents a pooling of 20,000 acres of properties in the U. S. and Canada. Bankers, industrialists, ranchers, financiers, oilmen and Utah mining men are among the directors and officers.

Nationwide wage demands have strengthened commodity prices because of the general conviction that another wave of cost increases has arrived. Business activity was exceptional in June, and despite labor disturbances, high rate of consumption for steel and other metals is assured for the rest of 1955.

Unless the people of the U. S. spend nearly $100-billion on new public works projects including roads, schools, public health, etc., during the next five years, minimum needs of our growing economy will not be met.

McGraw-Hill's Economic Department sums up the outlook this way—"You can head for that well-earned vacation with our assurance that business will still be high and rising when you get back." (This outlook however implies no predictions about the stock market.)

●

ABROAD

Atlas Corp.'s interest in Australian uranium (see p 73) seems to have evoked a wave of parallel interest among other overseas investors.

Lack of dollar exchange in Argentina is switching large tungsten mining and milling machinery orders from the U. S. to Europe.

A $12-million long-term machinery and equipment credit has been extended to Bolivia by the French firm "Titeux-Export." Bolivia also signed a long term $3-million credit agreement (36 to 48 months) with a German firm.

Corporacion Minera de Bolivia, official agency administering the nationalized tin mines has signed a contract with the German firm of F. Krupp of Essen to import on credit up to $1-million worth of machinery and materials for the mining centers. Payments are to be made within 48 months.

Active Trade in Metals Continues; Wage Agreements to Lift Costs

THE "BOOM" in the market for nonferrous metals continued throughout June. Activity in the first half of the year exceeded all expectations, thanks to a high rate of operation in all key industries. Except for the threat of labor trouble at copper properties as the month ended, operators felt that July would also make a creditable showing, even though vacations would curtail consumption in some lines. Ford and General Motors reached a wage settlement with automobile workers early in the month that included a supplemental unemployment plan. This caused workers in the steel and nonferrous metals industries to raise their sights appreciably. The market place interpreted these events as inflationary and disturbing to the stability of the price structure.

So far, the rising trend in production has not kept pace with the upward trend in consumption. Copper remains extremely tight and scared consumers have been inclined to acquire the metal for future delivery even though prevaling prices are looked upon as too high for the good of the trade.

The bill that suspends the copper import tax to June 30, 1958, was signed by President Eisenhower June 21.

E&MJ's index of nonferrous metal prices for June rose to 208.86, a new high. This compares with 208.08 in May and 184.61 in June a year ago. Higher averages for zinc, foreign silver and tin caused the rise. Platinum was higher on reduced offerings of Russian metal.

Copper producers in the U. S. held the line at 36c delivered even though pressure to raise the price continued. There was no evidence anywhere of any slackening in demand. Prices paid for copper produced outside of this country varied by as much as 9½c per pound in a single day's transactions. However, our weighted averages leaned to the lower end of the range. The price of £280 per long ton named by the Rhodesian Selection in the preceding month was continued, this time subject to change on 24 hours notice. This price, equivalent to roughly 35¢ per pound, was the lowest named by a major producer. Evidence that important European consumers are moving away from purchasing copper on the basis of the London Metal Exchange quotations is accumulating. Quotations on the Exchange again fluctuated over a wide range, with the low for the month in cash copper at £328½ asked, and the high at £352 asked. A strike of dockworkers hampered the movement of copper at U. K. ports.

Primary aluminum production in the U. S. in May totaled 131,128 tons, a new all-time high. Output in the first five months of 1955 totaled 632,233 tons, which compares with 594,641 tons in the corresponding period of 1954. Shipments of aluminum products in the first four months were 36% greater than in the like period of last year. Third-quarter "deferment" deliveries of metal to the stockpile, involving about 100,000 tons, is expected to help ease the supply situation in the light metal. The price situation in aluminum also is strong and a rise has occurred in the U. K. which could spread to other regions.

Lead sold in good volume on a sustained high level of consumption. The price here was firm but unchanged on the basis of 15c, N. Y. Senator Goldwater (Ariz.) introduced a bill that would provide for the purchase of lead and zinc for the stockpile at a minimum of 16c and 15½c, respectively. The measure met with strong opposition from spokesmen for industry and the Government. The GSA was in the market for both lead and zinc for delivery to the stockpile by Aug. 15. In view of the excellent demand for both metals the offers to the Government were light.

Zinc began to rise in price to 12½c East St. Louis early on June 16, when St. Joe moved up to that basis. However, most of the selling by others on that day took place at 12c, with the result that the *E&MJ* weighted average for June 16 turned out to be 12.025c. On the following day all sales were recorded at the higher level. That the price would rise was well advertised by tipsters for several weeks in advance of the date on which the change was announced, and consumers purchased substantial tonnages at the old level in anticipation of the rise. The extent of the rise was more or less limited by the uncertain behavior of the foreign market. Reaction to the latest rise on the London Metal Exchange was rather mild.

Tin was higher in the nearby position as offerings diminished in the face of a fair demand. There was more optimism among producers that the International Tin

Summary of Copper Statistics—Copper Institute

Production, deliveries and stocks of copper in the United States and outside of the United States, as reported by Copper Institute, figures in short tons:

United States

	Jan.	Feb.	March	April	May
Production:					
Crude, primary	86,931	89,078	98,171	93,669	95,148
Crude, secondary	8,879	13,264	10,239	10,559	11,734
	95,810	102,342	108,410	104,228	106,882
Refined copper	123,840	123,162	135,701	122,129	135,042
Deliveries, refined (a)	113,949	108,503	131,354	119,863	124,853
Stocks, refined	45,982	44,579	46,091	42,759	43,340

Outside United States

	Jan.	Feb.	March	April	May
Production:					
Crude, primary	109,582	114,260	133,530	137,567	135,002
Crude, secondary	350	208	319	283	574
	109,932	114,468	133,849	137,850	135,576
Refined copper	85,743	89,661	101,825	102,396	116,749
Deliveries, refined	113,035	116,752	103,764	101,552	108,924
Stocks, refined	159,296	144,337	148,973	158,076	176,620

(a) Includes tonnages delivered from Government stocks; also includes imports of foreign copper for account of Copper Institute members and others.

Average Prices for June (E&MJ Quotations)

Copper:	
Electrolytic, domestic refinery	35.700
Electrolytic, export, refinery	36.339
Lead:	
Common, New York	15.000
Common, St. Louis	14.800
Silver and sterling exchange:	
Silver, New York, per oz.	89.688
Silver, London, pence per oz.	77.977
Sterling Exchange, "Checks"	278.977
Zinc:	
Prime Western, East St. Louis	12.232
Prime Western, delivered (g)	12.732
Tin:	
New York Straits	93.625
New York, 99% min. (e)	92.625
Gold, per oz. U.S. price	$35.000
Quicksilver, per flask	$283.269
Antimony (E&MJ) (d)	31.970
Antimony, bulk, Laredo	28.500
Antimony, in cases, Laredo	29.000
Platinum, refined, per oz.	$79.077
Cadmium (a)	170.000
Cadmium (b)	170.000
Cadmium (c)	170.000
Aluminum, 99% plus ingot	23.200
Magnesium, ingot	28.500
Nickel (f)	64.500

Domestic quotations unless otherwise stated, are in cents per pound. Sterling exchange checks, in cents. Quicksilver, per flask of 76 lb.
(a) Cadmium average based on the producers' quotations.
(b) Cadmium average based on the average of the producers' and platers' quotation.
(c) Cadmium average based on platers' quotation.
(d) Domestic, 5 tons or more but less than carload lots, packed in case f.o.b. New York.
(e) Tin content.
(f) F.o.b. Port Colborne, U.S. duty included.
(g) Delivered where freight exceeds 0.5c.

MARKETS

Agreement would be ratified this year by Indonesia, the chief holdout.

Columbium-tantalum ore quotations remained unsettled and market authorities thought the price would drop back to the level that prevailed before the "bonus" doubled the figure at which GSA bought the mineral.

Silver of foreign origin was higher as European buyers again came into the market for supplies The price outlook favors producers.

Quicksilver was offered at sharply lower prices without attracting much business.

Manganese and chrome ores sold in larger volume as the high rate of operations in the steel industry began to cut into inventories. Higher freights served to strengthen prices. Tungsten ore also was firm, largely on purchased for Continental account.

"Free" Gold Market

Trading volume increased by about 65% during June, due to the sale of 2,570,000 oz of Russian gold to British and Swiss buyers. Prices showed little change in Europe but rose in Chile, Argentina and Brazil, reflecting economic and political unrest. Markets in the Far East were active with prices generally higher. Pick's World Currency Report quotes on "free" gold, per fine oz, as follows:

	COINS		BARS (12.5 kg)	
	May 31	June 30	May 31	June 30
NEW YORK, transit	.....	.....	$35.10	$35.10
MANILA	$39.50	$39.25	37.00	36.60
HONG KONG	39.50	39.50	37.85	38.00
BOMBAY	52.50	54.00	51.50	53.25
TANGIER	38.95	38.75	35.05	35.05
BEYROUTH	39.50	39.60	35.20	35.19
PARIS	40.20	39.90	36.25	36.00
BUENOS AIRES	42.75	42.50	37.90	39.75

Note: Prices are computed at the free or black market value of the U. S. dollar in the local markets.

Major Metals

U. S. DAILY AND AVERAGE PRICES

June 1955	Electrolytic Copper (a) Domestic	(b) Export	Straits Tin New York	Lead New York	Lead St. Louis	Zinc (f) Delivered	Zinc East St. Louis
1	35.700	35.725	91.625	15.000	14.800	12.500	12.000
2	35.700	36.025	91.875	15.000	14.800	12.500	12.000
3	35.700	35.625	91.750	15.000	14.800	12.500	12.000
4	No Market	35.875	91.750	15.000	14.800	12.500	12.000
6	35.700	35.825	91.750	15.000	14.800	12.500	12.000
7	35.700	36.000	92.125	15.000	14.800	12.500	12.000
8	35.700	36.800	92.125	15.000	14.800	12.500	12.000
9	35.700	35.850	92.625	15.000	14.800	12.500	12.000
10	35.700	35.975	93.250	15.000	14.800	12.500	12.000
11	No Market	35.975	93.250	15.000	14.800	12.500	12.000
13	35.700	35.475	93.875	15.000	14.800	12.500	12.000
14	35.700	37.025	93.625	15.000	14.800	12.500	12.000
15	35.700	36.800	93.625	15.000	14.800	12.500	12.000
16	35.700	36.225	94.375	15.000	14.800	12.525	12.025
17	35.700	37.200	94.375	15.000	14.800	13.000	12.500
18	No Market	36.375	94.375	15.000	14.800	13.000	12.500
20	35.700	38.275	94.375	15.000	14.800	13.000	12.500
21	35.700	36.050	94.500	15.000	14.800	13.000	12.500
22	35.700	36.400	94.500	15.000	14.800	13.000	12.500
23	35.700	36.100	94.625	15.000	14.800	13.000	12.500
24	35.700	36.900	94.875	15.000	14.800	13.000	12.500
25	No Market	36.900	94.875	15.000	14.800	13.000	12.500
27	35.700	36.550	94.875	15.000	14.800	13.000	12.500
28	35.700	36.050	95.000	15.000	14.800	13.000	12.500
29	35.700	36.325	95.000	15.000	14.800	13.000	12.500
30	35.700	36.500	95.250	15.000	14.800	13.000	12.500
AVERAGES FOR MONTH							
June	35.700	36.339	93.625	15.000	14.800	12.732	12.232
AVERAGES FOR WEEK							
June							
1	35.700	36.504	91.625	15.000	14.800	12.500	12.000
8	35.700	36.025	91.896	15.000	14.800	12.500	12.000
15	35.700	36.183	93.375	15.000	14.800	12.500	12.000
22	35.700	36.754	94.417	15.000	14.800	12.921	12.421
29	35.700	36.471	94.875	15.000	14.800	13.000	12.500
CALENDAR WEEK AVERAGES							
June							
4	35.700	36.183	91.700	15.000	14.800	12.500	12.000
11	35.700	36.071	92.521	15.000	14.800	12.500	12.000
18	35.700	36.517	94.042	15.000	14.800	12.671	12.171
25	35.700	36.771	94.625	15.000	14.800	13.000	12.500

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis. All prices, except gold and silver, are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.300c per pound, the average differential for delivery charges.

(b) Our export quotation for copper reflects prices obtaining in the open market and is based on sales in the foreign market reduced to the f.o.b. refinery equivalent, Atlantic seaboard. On f.a.s. transactions we deduct 0.075c for lighterage, etc., to arrive at the f.o.b. refinery quotation.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries: tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingotbars; cathodes are sold at a discount of 0.125c to 0.15c per pound. Quotations for zinc are based on Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East, Middle West, and West, effective Jan. 1, 1951, commanded a premium of 1.35c per pound over the current market for Prime Western; Special High Grade 1.50c.

(f) Prime Western delivered where freight from E. St. Louis exceeds one-half cent.

Quotations for lead are based on domestic common lead. Corroding lead commands a premium of 10 points.

(c) The daily silver quotation reported by Handy & Harman, in cents and fractions of a cent per troy ounce, is the price paid by Handy & Harman in settlement for silver contained in unrefined silver-bearing materials submitted to them for refining. It is determined on the basis of offers of bar silver .999 fine as made to Handy & Harman for nearby delivery at New York by regular suppliers in quantities sufficient to meet daily requirements, and it is usually one quarter cent below the price at which such offers are made.

The Treasury's purchase price of newly mined domestic silver is 90.5 per troy ounce 1000 fine, effective July 1, 1946. London silver in pence per troy ounce, basis .999 fine.

(d) U.S. Treasury's gold price. Actual payment by the United States Treasury for gold is at 99.75 per cent of the price quoted by the Treasury, which is equal to $34.9125.

Silver, Gold and Sterling

DAILY AND AVERAGE PRICES

June 1955	Sterling Exchange "Checks"	Silver (c) New York	Silver London	Gold London	Gold (d) United States
1	279.4866	90.500	78.500d.	250s. 11d.	$35.00
2	279.4151	90.500	78.500d.	250s. 10d.	35.00
3	279.3080	90.500	78.500d.	250s. 11d.	35.00
4	(e)	(e)	(e)	(e)	35.00
6	279.1197	90.250	78.500d.	251s. 0d.	35.00
7	279.3958	90.250	78.500d.	251s. 0d.	35.00
8	279.3883	89.750	78.250d.	250s. 10½d.	35.00
9	279.3125	89.750	78.250d.	250s. 11d.	35.00
10	279.1428	89.750	78.250d.	250s. 11½d.	35.00
11	(e)	(e)	(e)	(e)	35.00
13	279.2901	89.250	78.250d.	250s. 11½d.	35.00
14	279.4062	89.250	77.750d.	250s. 10½d.	35.00
15	279.1250	89.250	77.500d.	250s. 10½d.	35.00
16	279.1696	89.250	77.500d.	251s. 1d.	35.00
17	278.9821	89.250	77.250d.	251s. 1d.	35.00
18	(e)	(e)	(e)	(e)	35.00
20	278.9270	89.250	77.250d.	251s. 2½d.	35.00
21	278.7901	89.250	77.250d.	251s. 3½d.	35.00
22	278.5044	89.250	77.250d.	251s. 4½d.	35.00
23	278.5625	89.250	77.250d.	251s. 7½d.	35.00
24	278.5000	89.250	77.250d.	251s. 6½d.	35.00
25	(e)	(e)	(e)	(e)	35.00
27	278.3750	89.250	78.000d.	251s. 8½d.	35.00
28	278.3616	90.000	78.250d.	251s. 9d.	35.00
29	278.4375	90.000	78.750d.	251s. 9d.	35.00
30	278.5000	90.125	78.750d.	251s. 9d.	35.00
AVERAGES FOR MONTH					
June	278.977	89.688	77.977	—	35.00
AVERAGES FOR WEEK					
June					
1	279.352	90.375	—	—	—
8	279.325	90.250	—	—	—
15	279.255	89.450	—	—	—
22	278.875	89.250	—	—	—
29	278.447	89.550	—	—	—

Calendar Week Averages: New York Silver: June 4th, 90.500 11th, 89.950; 18th, 89.250; 25th, 89.250.
(e) No Market (Saturday).

London Metal Exchange Quotations

	COPPER				LEAD				ZINC				TIN			
	Cash		3 Mo.		Current Month		3 Mo.		Current Month		3 Mo.		Cash		3 Mo.	
June	Bid	Asked	Bid	Asked	Bid	Asked	Bid	Asked	Bid	Asked	Bid	Asked	Bid	Asked	Bid	Asked
1	333	334	319	320	103	103¼	102¾	103	91¼	91½	89½	89¾	718	718½	718	718½
2	342½	345	328½	329½	103	103¼	102¾	103	91¼	91½	89¼	89½	717	718	717½	718
3	348	349	330	330½	103	103¼	102¾	103	90½	90¾	88¾	89	718½	719	718½	719
6	348	349	328	330	102	102¼	102	102¼	88¾	89¼	87¼	87½	715½	716	716½	717
7	351	352	333	334	102¾	103	102¾	103	90¼	90½	88¾	89¼	718	718½	719	719½
8	350½	351½	333	334	103	103¼	103	103¼	91¼	91½	89½	89¾	720	720½	720½	721
9	340½	341	324	324½	102¾	103	102¾	103	90¾	91	89¼	89½	721	721½	721½	722
10	339	339½	323	324	102½	103¼	103½	103¼	91½	91¾	90	90¼	725½	726½	726½	727
13	339	340	325	326	102¾	103	102¾	103	92¼	92½	90½	91	728½	729	728½	729
14	343	344	329½	330½	102	102¼	102½	102¾	92¼	92½	90½	90¾	728	728½	727½	728½
15	344	345	332	332½	102¼	102½	102½	102¾	91½	91¾	90	90¼	727	728	727	727½
16	347	349	336	337	102¼	102½	102½	102¾	91¾	92	90¼	90½	729	729½	729	729½
17	349	351	338½	339	102½	102¾	102½	102¾	92	92¼	90½	91	729	731	729	731
20	350½	352	337½	338½	102¾	103	102½	102¾	92¼	92½	90¾	91	724½	725	725	726
21	349	350	337	338	103	103¼	102¾	103	91¾	92	90½	90¾	725	726	725	726
22	344	345	332	334	102½	102¾	102¼	102½	91¼	91¾	90	90½	725½	726	725	726
23	339	340	329	330	102½	102¾	102¼	102½	91¼	91½	90¼	90½	724	725	724	725
24	328	328½	322	323	102½	102¾	102¼	102½	91	91¼	89¾	90	723½	724	723½	724
27	333	334	326	327	102¾	103	102½	102¾	91	91½	90	90¼	726½	727	726½	727
28	339	340	330½	331½	102¾	103	102½	102¾	91	91¼	90	90¼	726	726½	725½	726½
29	341½	342½	335½	336	103	103¼	102½	102¾	91¼	91¾	90¼	90½	726	726½	725½	726
30	337	337½	332½	333	103¼	103½	102¾	103	91½	91¾	90¼	90½	727½	728	726½	727
Av'g's	£343.068		£330.545		£102.815		£102.702		£91.398		£89.955		£724.136		£724.239	

Prices are for the official a.m. session in pounds sterling per ton. Copper basis wire bars, lead 99.97%, zinc 98% and tin min. 99.75%.

Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipments f.o.b. New York unless otherwise stated, tons of 2,000 lb unless otherwise noted.

MISCELLANEOUS METALS

June 30, 1955

Aluminum ingot, 99 plus % lb			23.2¢
Antimony, spot, lb, less than carload, in cases			31.97¢
In bulk, carload lots, f.o.b. Laredo			28.50¢
Bismuth, ton lots, lb			$2.25
Cadmium, commercial sticks, delivered, lb			$1.70
Calcium, lb, ton lots, 98%, cast			$2.05
Chromium, 97% grade, lb, contract			$1.18
Cobalt, 9 to 99%, per lb			$2.60
Germanium, lb			$295.00
Indium, troy oz			$2.25
Lithium, lb, 98%	$11.00	@	$12.00
Nickel, cathodes, lb, f.o.b. Port Colborne (a)			64½¢
Magnesium, 99.8%, carloads, lb, producer's plants, Freeport, Texas			28½¢
Palladium, troy oz	$20.00	@	$21.00
Platinum (wholesale lots) troy oz	$79.00	@	$81.00
Quicksilver, flask of 76 lb, 25 flasks or more	$278	@	$280
Selenium, 99 plus %, lb	(b)$6.00	@	$7.25
Silicon, minimum 97%, carloads, lb			18¢
Tellurium, lb			$1.75
Thallium, 100 lb or more, lb			$12.50
Titanium, 99.3 plus, grade A, max. 3% iron, lb			$3.95

(a)Includes U. S. duty. (b)Depending on quantity.

METALLIC ORES

Beryllium Ore, imported, 10% BeO, per short ton unit	$36.00	@	$38.00
Chrome Ore per long ton, f.o.b. cars Atl. ports, dry:			
44% Cr_2O_3 no ratio	$22.00	@	$23.00
48% Cr_2O_3 3 to 1 ratio	$43.00	@	$53.00
Iron Ore, Lake Superior, Lower Lake ports, long ton:			
Old Range bessemer			$10.40
Mesabi bessemer			$10.25
Mesabi, non-bessemer			$10.10
Lead (Galena), 80%, Joplin, Mo., ton			$187.85
Manganese Ore—Per long ton unit of Mn basis 48% manganese, nearby positions, subject to premiums and penalties 91 @ 93¢ c.i.f. U. S. ports, duty extra. Long-term contract nominal at 89 @ 90¢ c.i.f. duty extra.			
Molybdenum Ore, 90%, per lb of Mo f.o.b. mines			$1.05
Columbium-Tantalum, per lb, combined oxides			(a)
Tungsten Ore, per unit of WO_3:			
Foreign 60%, c.i.f. U. S. ports, duty extra	$32.00	@	$33.00
Domestic, scheelite, 60% f.o.b. mill			$63.00
Vanadium Ore, per lb of contained V_2O_5 f.o.b. mines			31¢
Zinc Ore, Prime, 60% concentrate, Joplin, Mo., per ton			$76.00

(a) Nominal.

METALLIC COMPOUNDS

Arsenous Oxide (arsenic trioxide) lb, in bbl carload lots delivered			5½¢
Cobalt Oxide, 72½% to 73½%, ceramic grade, per lb	$1.96	@	$1.97½
Copper Sulphate, 100 lb			$12.25
Germanium Oxide, lb			$142.00
Molybdic trioxide, technical, per lb of Mo	$1.24	@	$1.25

ALLOYS

Ferrochrome 65 to 69%, per lb of Cr, (4-9% C)			24½¢
Ferromanganese, 74-76%, net ton, seaboard			$190
Ferromolybdenum, 55 to 65% Mo, lb of Mo contained	$1.49	@	$1.57
Ferrosilicon, 50% per lb of contained Si			12¢
Ferrotungsten, 72 to 82%, lb of W contained			$3.38
Ferrovanadium, per lb of V delivered	$3.00	@	$3.25
Silicomanganese, max. 1½% carbon, lb, contracts			11.4¢
Spiegeleisen, per long ton, 19 @ 21% grade			$86.00

NON-METALLIC MINERALS

Asbestos, f.o.b. Canada (Quebec) mines (U. S. funds) ton:			
Crude No. 1	$960	@	$1,500
Crude No. 2	$595	@	$900
Spinning fibers	$321	@	$514
Shingle fibers	$150	@	$200
Paper stock	$109	@	$137
Waste			$77
Shorts	$35	@	$70
Asbestos, f.o.b. Vancouver, B. C. (U. S. funds):			
Spinning fiber, 3-K			$460
Shingle fiber, 4-K			$185
Asbestos, Vermont, f.o.b. Hyde Park:			
Spinning fibers	$279.50	@	$302.00
Shingle stock	$135.00	@	$162.00
Paper stock	$81.50	@	$115.00
Waste, stucco or plaster			$71.40
Refuse or Shorts	$34.00	@	$63.00
Barytes f.o.b. cars:			
Georgia, crude, per ton			$15.00
Missouri, 94% $BaSO_4$, per short ton			$13.25
Bauxite, long ton, f.o.b. point of shipment:			
Domestic crude, 50 to 52% (not dried)	(a)$5.00	@	$5.50
Domestic, chemical, 55 to 58%	(a)$8.50	@	$9.05
Domestic, abrasive, 80 to 84%	(a)$18.00	@	$18.50
Feldspar, bulk ton:			
Potash or soda feldspar, 200 mesh, ceramic grade	$18.50	@	$22.25
Glass feldspar, white, 20 mesh	$11.75	@	$12.50
Fluorspar, f.o.b. mines, bulk, 72½% effective, ton	$29.00	@	$30.00
60% effective CaF_2	$26.00	@	$27.00
Acid 97% concentrate, bulk, ton			$47.50
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00	@	$14.00
Magnesite, per ton dead-burned, bulk, f.o.b. Washington			$38.00
Mica—Domestic, f.o.b. mines. Punch 12 to 22¢ per lb according to size and quality. Sheet clear, 1½ x 2-inch, 70¢ to 85¢; 2 x 2 inch, $1.10 to $1.60; 2 x 3 inch, $1.50 @ $1.60; 3 x 3 inch, $1.80 @ $1.90; 3 x 4 inch, $2.20; 3 x 5 inch, $2.40; 4 x 6 inch, $3.15; 6 x 8 inch, $4.25. Wet ground, very fine, $140 @ $155 per ton. Bulk sales, dry ground: $32.50 @ $70.00 per ton. Scrap $25 and up.			
Ocher, Georgia, ton, in sacks	$26.50	@	$30.00
Pyrites, Spanish, per long ton unit of S, c.i.f. Atlantic ports			Not quoted
Sulphur, Texas, mines, long ton	$25.50	@	$27.50
Talc, f.o.b. works ton			
New York, purified	$18.50	@	$20.00
Vermont, extra white			$13.50
Tripoli, Missouri, ton:			
40-mesh, cream colored			$30.00

(a) Nominal.

IRON AND STEEL

Pig Iron, gross ton, basic, Valley Furnaces			$56.00
Steel f.o.b. Pittsburgh, billets, net ton			$64.00
Structural shapes, Pa., Ala. etc., 100 lb			$4.25

STOCKPILE of uranium ore at the American Smelting and Refining Co. sampler, near site of new mill, holds an estimated 200,000 tons of ore from Mi Vida, Standard Uranium Co. properties, other Big Indian Wash district operations.

Photos by Salt Lake City Tribune

FINAL trustee papers are studied by Steen, Ed Snyder and Paul B. Martin, assistant counsel for AEC, GJOO.

Eleventh Mill Will Handle Moab Ores

WORK HAS ALREADY BEGUN on the nation's largest uranium mill, to be built by Uranium Reduction Co. three miles west of Moab, Utah, on the banks of the Colorado River. Mill, to cost an estimated $8-million, will handle stockpiled ore from the Charles A. Steen Mi Vida mine and from other neighboring producers.

New installation, to be managed by American Zinc, Lead and Smelting Co. (a minority stockholder of Uranium Reduction), will employ a resin-in-pulp process developed by the Atomic Energy Commission at its Grand Junction, Colo., pilot plant. Target for completion of the mill is 12 to 15 months.

Size of the mill is classified according to AEC, but all official sources agree that the operation represents the largest of its kind so far built in the Plateau area. Ore stockpiled to date at the AEC sampler near the site, operated by American Smelting & Refining Co., contains a reported 200,000 tons. Other area suppliers besides Mi Vida include Standard Uranium Co. and other Big Indian Wash producers. (See photo.)

Officers of the new company include E. H. Snyder, Combined Metals Reduction Co., Salt Lake, chairman; Mitchell Melich, attorney for Utex Exploration Co., president; Steen, president of Utex, vice president; Richard A. Young, vice president of American Zinc, executive vice president.

Directors of Uranium Reduction are E. T. Foley, Foley Brothers Inc.; Percy M. Stewart, Kuhn, Loeb & Co., New York; and Howard I. Young, president of American Zinc. Foley Brothers, who broke ground for the new mill under erection contract with Uranium Reduction, is credited with securing the financing of the venture through Kuhn, Loeb and Chemical Corn Exchange Bank and New York Life Insurance Co. It was the first time in American business history that a life insurance company participated in financing a uranium mill venture.

Steen's Utex Exploration Co. holds "slightly less" than 50% of the common stock of the new organization. He has "operating control" of the firm and, under a trusteeship agreement, for six years is given 80% control of the firm with the right to name directors.

Equity capital for the venture (about $10-million) was furnished by Utex, Foley Bros., American Zinc, Combined Metals Reduction and others.

Over-all engineering and design for the plant is under contract to Combined Metals Reduction Co. Knowles Associates of New York are handling the detailed design and engineering of the leaching and concentrate recovery sections of the mill.

In addition to the milling program, Uranium Reduction Co. plans an exploration and mine development drive independent of associated firms.

URC owns the Wanda and Cherie Group of claims which adjoin on the north the claims formerly owned by the Big Indian Mines, Inc. These Big Indian claims, adjacent to the Utex Exploration Co.'s holdings on the west, are now the property of the Big Indian Venture. This latter grouping is a joint venture between Uranium Reduction Co. and Standard Uranium Co., successor to the Big Indian Mines, Inc.

$½-million has been provided by Uranium Reduction Co. for the development of claims in the Big Indian Venture.

Negotiations leading to actual breaking of ground on the mill have been under way for nearly 13 months.

There were many who frankly stated an "independent" outfit could not secure funds, backing and AEC approval for a venture this size.

With construction of the new venture, total number of mills on the Plateau will be eleven: nine now in operation—at Rifle, Durango, Naturita, Uravan and Grand Junction, Colo.; Shiprock and Grants, N. M.; Salt Lake City and Monticello, Utah—and two under construction, at Edgemont, S. D. and the new Uranium Reduction Co. mill at Moab.

Kennecott Joins Moly In Oka Development

KENNECOTT COPPER CORP. and Molybdenum Corp. of American have announced joint development of a columbium-tantalum ore deposit at Oka, Quebec, on the St. Lawrence River. Arrangement for the development reportedly also includes an option for Kennecott to acquire 51% interest in Moly Corp.'s rights to the property.

Kennecott also is reported planning to purchase some 50,000 shares of Moly common stock (750,000 authorized) for investment purposes.

Oka development has been described by Marx Hirsch, president of Moly Corp., as a major discovery with huge indicated reserves. Drilling has been going on at the site for some time and is still continuing.

Government purchases of columbium-tantalum ores for stockpile were terminated in May with announcement that the U. S. had sufficient quantities on hand and commitments signed to provide for the purchase program goal.

Hoskins Mound Mine Closed by Freeport

HOSKINS MOUND, which has been in operation longer than any other U. S. sulphur mine, was closed on May 27 due to the exhaustion of the deposit.

Freeport Sulphur Co. began production in 1923 at the mine near Freeport, Tex. Since that time Hoskins has produced about 11-million long tons of sulphur.

Shortly before the closing, the company announced plans to develop a newly discovered deposit at Lake Pelto located in the Louisiana tidelands about 60 miles southwest of New Orleans.

To minimize the effect of the closing, many workers have been transferred to Freeport's other mines, and those who had to be laid off were paid termination benefits based on service and age and amounting in many cases to more than a year's pay.

Brazil, Colombia Initial "Atoms For Peace" Accords

FOLLOWING NEGOTIATIONS of President D. D. Eisenhower's "Atoms for Peace" program, the Republic of Colombia and the United States of Brazil initialed proposed agreements for interchange of information of design, construction and operation of power-producing nuclear reactors for peacetime use.

Signatories for the Latin American nations were: for Brazil, Ambassador Joao Carlos Muniz; for Colombia, Ambassador Eduardo Zuleta Angel.

Giant Aerial Survey Starts in Canada

BIGGEST geological survey in history of Canadian North will get under way this summer when potential mineral and oil resources of a group of Arctic islands named after Queen Elizabeth will be determined by geological survey branch of Canadian Government's department of mines and technical surveys.

"Operation Franklin," as it will be known, is expected to yield enough information to determine whether the area should be further explored by private companies. Survey will cover about 120,000 sq miles, including islands of Somerset, Devon, Bathurst and Melville, and the islands will be studied by aerial and ground survey parties and by airborne magnetometer.

Dr. L. W. Morley will be in charge of magnetometer work.

Magnetometers will also be used in an effort to learn how far the continental shelf extends into the Arctic seas and to check a Russian report that an undersea

(*Continued on page 124*)

As we went to press . . . . .

First ore is due from the Veteran Pit, Kennecott's latest operation in Nevada, sometime this month. Following stripping by Isbell Construction Co., 168,000 tons of ore are now available. Through the next 11 or 12 years, pit is expected to produce some 20-million tons of less than 1% copper.

Mineral study of uranium deposits in Rajasthan, India, is included in $40-million exploration financed by ministry for natural resources and scientific research. Also included in the new program are plans for a search for radioactive minerals in the State of Andhra and expansion of the Panna diamond mines, where Russian technicians are now producing industrial diamonds.

Following field checks by geologists for Atlas Corp. over a 700 sq mile area in the Alligator River District of North Australia, the U. S. firm, controlled by Floyd B. Odlum, has purchased £A562,500 worth of treasury stock of North Australian Uranium Corp. Purchase (U.S. $1,254,375) makes Atlas the largest stockholder.

American Smelting & Refining Co., operator of several buying stations on the Colorado Plateau for AEC, will also operate the new installation at Globe, Ariz., opened July 5. AS&R's other stations are at Monticello, Moab, Marysvale, Utah, Edgemont, S. D., and Riverton, Wyo.

American Gilsonite Co., jointly owned by Standard Oil of California and Barber Oil Co., will spend more than $10-million to manufacture high-test gasoline and metallurgical coke from its gilsonite deposits in Bonanza, Utah. Program includes construction of a refining plant in western Colorado and expansion of mining at Bonanza. Gilsonite will be mined hydraulically and moved to the refinery via pipeline. Initial capacity has been estimated at 600 to 700 tpd.

Kerr-McGee Oil Industries, Inc., Oklahoma City, opened its processing mill at Shiprock, N. M., June 18. Mill will handle ores from the Navajo Indian Reservation, northwest New Mexico.

Stockpiling of lithium ore at San Antonio, Tex., for the new American Lithium Chemicals plant began late last month. Plant construction will not be completed 'til Dec. 1, 1955. Lepidolite ore (11,000 tons), from Bikita Minerals, Ltd., Southern Rhodesia was loaded into railroad hopper cars at Corpus Christi for shipment to San Antonio. American Potash & Chemical Corp., Los Angeles, holds substantial interest in American Lithium and Bikita Minerals.

International Minerals and Chemical Corp. has purchased the TVA Godwin phosphate plant at Columbia, Tenn. IM&CC will expand production of phosphate rock in the area to approximately 3,000 tpd, according to future plans of the firm.

Behind the By-Lines...

G. P. Lutjen

This month, in addition to giving the miners in the audience some dope on air flush drilling (see p 80) and the metallurgists a word or two about how Bunker Hill blends its charge for better smelting (p 83), we have a couple of items on the bill of fare for the poor guys who get their set of ulcers trying to keep all the equipment running.

On pp 88 through 91, Messrs. H. A. Wright and Thad F. Bellinger of the Control Department of Allis-Chalmers give you a few hints in "How To Protect Crusher Motors Against Operating Hazards." We never realized how tender crusher motors were until we read about how they should be protected from too many starts, overheating, overloads, voltage fluctuations and sundry other afflictions. This article may be to crusher motors what the Four-Way cold tablet is to the crusher foreman.

Then on pp 92 through 95, W. P. Schmitter, vp and chief engineer of the Falk Corp., gives us the word on the problems of gears in ball mills and kilns, and how the helical gear can help solve them. It seems the answer lies in the maximum load which the gear tooth has to put up with. But this is Mr. Schmitter's story and he knows his subject inside out.

It was Peoria in carnival mood that we visited last month, on a non-secret mission to the Caterpillar Tractor Co. Upwards of 150 members of the press were on hand for a preview of new developments at Caterpillar. What we did was guinea-pig a large scale exposition that the company was planning for its dealers who were due to flood Peoria as we ebbed.

Our day with Caterpillar started breakfast—early on a Wednesday morning, with eggs and bacon followed by a movie and a walking tour of the Caterpillar diesel engine plant. This plant trip was a heads up job and we heartily endorse it if your company is given to conducting hordes of visitors through mine, mill or plant. Groups of 10 were assigned to each guide who herded us from station to station in a pretty well marked route. At each station an attractive display sign gave salient information like "Three million bolt holes reamed here daily." There was also a technician standing by with a short commercial on what was going on among the busy machines. To do the job satisfactorily each of these barkers was equipped with one of those electronic megaphones that amplify the voice above the roar of the machinery without causing the speaker to blow a tonsil. (We noted that one resourceful young engineer stood behind us as we looked on the equipment he was describing. We sneaked a look and he was reading the whole spiel from a 6 x 9 card.)

But ad libbed or cribbed, the brief talks were excellent and just about answered all the questions before they got off the ground. On the way from the medium size engine assembly line to the large engine testing department, a question occurred to us. We asked how many engines did they make in the plant. The guide said he didn't know and if he did he couldn't tell us. But he *was* awfully polite about it.

A good reporter should be able to give you all kinds of startling figures like acres of plant, size of machines and such, but after the first hour of the march around the plant we tired rapidly and began jettisoning excess baggage. The old notebook along with a copy of Lincoln's Gettysburg Address engraved on the head of a pin were among the early items to go. So no figures.

After a nourishing lunch at the plant cafeteria, buses took the entire group out to the company's proving grounds for what may be described as a tractor rodeo. Sitting in a grandstand, set on a high mound overlooking a plain of plain dirt, we reviewed a parade of Caterpillar products for mine, construction project and farm. Shortly after the last item pranced by, a shot was fired on a long low hill off to the right and over the top of the hill, 8 abreast, came a line of tractors like the U. S. cavalry in the last reel of an old-fashioned Western. By jiminy, it was a sight to stir the diesel oil in your veins!

Then all these tractors, from the monstrous D-9 to what must have been the D-0.5, began romping around the plain in front of the grandstand and aided and abetted by scrapers, carryalls and whatnot, they began a serious rearrangement of the topography right before our eyes.

It was an impressive display but what touched us most was two extremely busy little front-end loaders making an excavation off by themselves in front of the grandstand. No sooner did they have a respectable hole dug when along came this dirty old D-9. With blade lowered, the D-9 in one majestic pass filled in the afternoon's work. We felt that there was a lesson there somewhere as, crestfallen, the little loaders clanked dejectedly off the field.

From our earliest days in the caddy business until now we have never really understood golf or golfers, but linksmen of our acquaintance are telling this story to each other with obvious merriment, so we are passing it along.

It seems that Melvin Dub's devotion to golf was the legend of Gooey Hollow Country Club. Day in, day out, Dub could be found on the course, putting and swearing. In the rain, he wore hip boots, in the snow he used green golf balls.

One spring day, Dub and an old golfing friend were playing an early round at two-bits a hole. The match proceeded apace until the golfers came to the 6th tee which happened to lie right next to a main street. Just as old Dub was about to drive off the tee, a funeral procession passed slowly by and to the wonderment of his companion, Dub turned from the ball and stood erect, holding his cap over his heart.

When the procession had passed, Dub resumed his stance only to be interrupted by his friend. "Dub," he said, "I never thought I'd see the day that anything would interfere with your playing golf. I'm touched by this respect you've demonstrated."

"Well, after all," Dub replied, once more addressing the ball, "We would have been married 18 years next Thursday."

LOADING TOWER and boom travel 54 ft. Boom is lowered to reduce fall of pellets. Dock is 1200 ft.

SEEN FOR THE LAST TIME is one of 25 chute gates to loading conveyor from 25,000-ton pellet capacity storage pit. Pit is filling now.

Marmora Mine and Plant Ships Pellets To Feed Bethlehem's Blast Furnaces

WITH THE SAILING of the *SS Powell Stackhouse* from the Marmoraton Mining Co., Ltd., dock at Picton, Ontario May 11, the first boatload of iron ore pellets from the Bethlehem Steel Corp. subsidiary's Marmora open pit mine left for the corporation's blast furnaces at Lackawanna, N. Y.

Among the officials attending the first shipment of ore from Marmora were the Honorable Leslie Frost, premier of Ontario; C. D. Howe, minister of trade and commerce; Ralph Campney, Minister of National Defense; Donald Gordon, chairman and president of Canadian National Railway; and A. B. Homer, president of Bethlehem Steel Corp.; W. H. Kyle and S. F. Dingle, both of CNR.

Ceremony marked fruition of a project begun five years ago when Bethlehem's geologists obtained options on a 290-acre tract where an Ontario Department of Mines and Geological Survey of Canada survey showed an interesting aeromagnetic anomaly.

Iron ore pellets were delivered to the ore carrier via a unique loading boom, set in the side of a cliff on Quinte Bay, Lake Ontario. Rectractable loading boom is designed for shuttle travel of 54 ft perpendicular from the face of the cliff, to permit loading and trimming of vessels of different beams and for even loading of carrier's holds. A 16,000-ton ore boat can be loaded in about 10 hours.

Loading boom controls are housed in a steel tower atop the shuttle conveyor and traveling with it.

A 1200-ft dock, supported by steel piling, with a 240-ft loading section, accommodates the largest of lake carriers.

Lake ore carriers will travel 211 miles from the excellent harbor provided by the Bay of Quinte to the parent company's blast furnaces via the Welland Canal.

Pellets from Marmora Mine, 64 miles away, arrive by rail car and are dumped in an 800-ft long storage pit, cut from solid rock about 80 ft back from, and parallel to, the cliff. Pit is 30 ft deep and has storage space for 25,000 tons of pellets. Winter stockpiling space is also available alongside the pit for some 330,000 tons of pellets. Crane with clamshell transfers pellets from pit to ground surface and vice versa. Bottom dump rail cars ride a trestle over the storage pit.

Pellets are drawn from the bottom of the pit by 25 chute gates to the recovery tunnel and conveyor beneath. Gates are operated manually and discharge onto a 42-in. belt conveyor which in turn feeds a duplicate 500 fpm, 2000-ton capacity belt running at a right angle to it, out towards the water. Second belt feeds pellets (through water spray) to third conveyor, mounted on retractable loading tower and boom.

Service building at Picton dock houses general office, welfare facilities, a shop and customs house.

Iron ore from the Marmora open pit averages 37% Fe and is beneficiated to bring it up to the 65% Fe-containing pellets. Ore is a replacement deposit of Precambrian limestone and was overlain by some 130 ft of flat-lying Palaeozoic limestone. Deposit is low-grade magnetite, occurring as stringers and irregular masses mixed with the Precambrian limestone and intrusive dikes. Orebody is estimated roughly as an oblong mass 2100 ft long and up to 400 ft wide.

Present plans estimate annual production of 500,000 tons of pellets, which will require mining approximately 2-million tons of ore and waste each year from the 1200-ft wide by 2600-ft by 120-ft deep pit. Pit will ultimately go down to 500 ft in 45-ft benches. Pit is notable as an example of "good housekeeping." Benches, faces and floor are smooth.

PLANT takes ore from pit, beneficiates, and loads pellets into cars. Dumps are at top; maintenance and offices, foreground.

PELLETS are stored in pit, conveyed behind cliff to loading boom, then to ship. Crane handles winter storage beside pit.

PIT is "whisk-broom clean." Skip hoist (left, below) feeds primary crusher, hoisting 4,250 tpd via 22-ton skips in balance.

Mining will require removal of some 14-million tons waste rock along with the crude ore.

Stripping was carried on 24 hours per day, removing approximately 20.5-million tons of rock. Stripping operations started in March 1952. During stripping, trucks operated 15 to a shift, were greased every 24-hour period and the oil changed every week.

Two rotary drills, electrically powered and equipped with 6¾-in. bits, drill the 45-ft limestone benches on 25-ft centers, at 22 to 30 ft per hour in the stripping operation. Rotary Tri-cone rock bits were used in stripping. Bit life averaged 1300 ft, with the record at 3200. Four wagon drills and four jackhammers were used for the small amount of secondary drilling and scaling necessary. Compressed air is furnished by one 500-cfm and two 315-cfm portable compressors.

For primary blasting, 5-in. by 16-in. cartridges of 50-, 60- and 70% dynamite are used. Blasting averages 4.5 tons limestone per lb explosive. A single row of holes is shot with Primacord and electric millisecond delay caps used as detonators. On a regular blast, two "O" delays are used at the center with progressive delays of 1 to 8 at either side. Almost 100% fragmentation has resulted from this procedure.

Overburden was loaded into 21 rear-dump 22-ton capacity 300-hp diesel trucks by 6 cu yd electric shovels. Waste rock was either hauled to dumps or used as aggregate and fill in road building and plant construction.

Switching from stripping to mining, all equipment but rotary drills is used. Three pneumatic drills with 6-in. tungsten carbide bits were added for use in hard rock and ore. Shovels were converted from 6 cu yd to 4 cu yd for ore handling.

Ore is dumped into a loading pocket in the pit floor which accommodates a 22-ton skip, equal to the truck load. Two skips work in counterbalance on a 45-degree incline and deliver the full load to the primary crusher. Incline is now 240 ft long and will be lengthened to accommodate lowering of the pit floor. With normal operation, 4,250 tpd will be hoisted.

Waste is hauled to one of several dumps, all located for easy disposal. Blasting caps and dynamite are stored in three magazines.

They are surrounded by the waste piles. Added safety factor derived from this protection has been favorably noted by Canadian mine safety officials. Pit operations are carried on in two shifts.

HOIST POCKET, set in pit floor, accommodates two 22-ton skips. Trucks dump directly into skips; one truckload fills. Mining operation works in two shifts daily.

COUNTERBALANCED SKIPS travel from pocket to top of primary crusher. Hoist travel is now 240 ft, will be extended as pit floor lowers. Skips travel 45-deg incline.

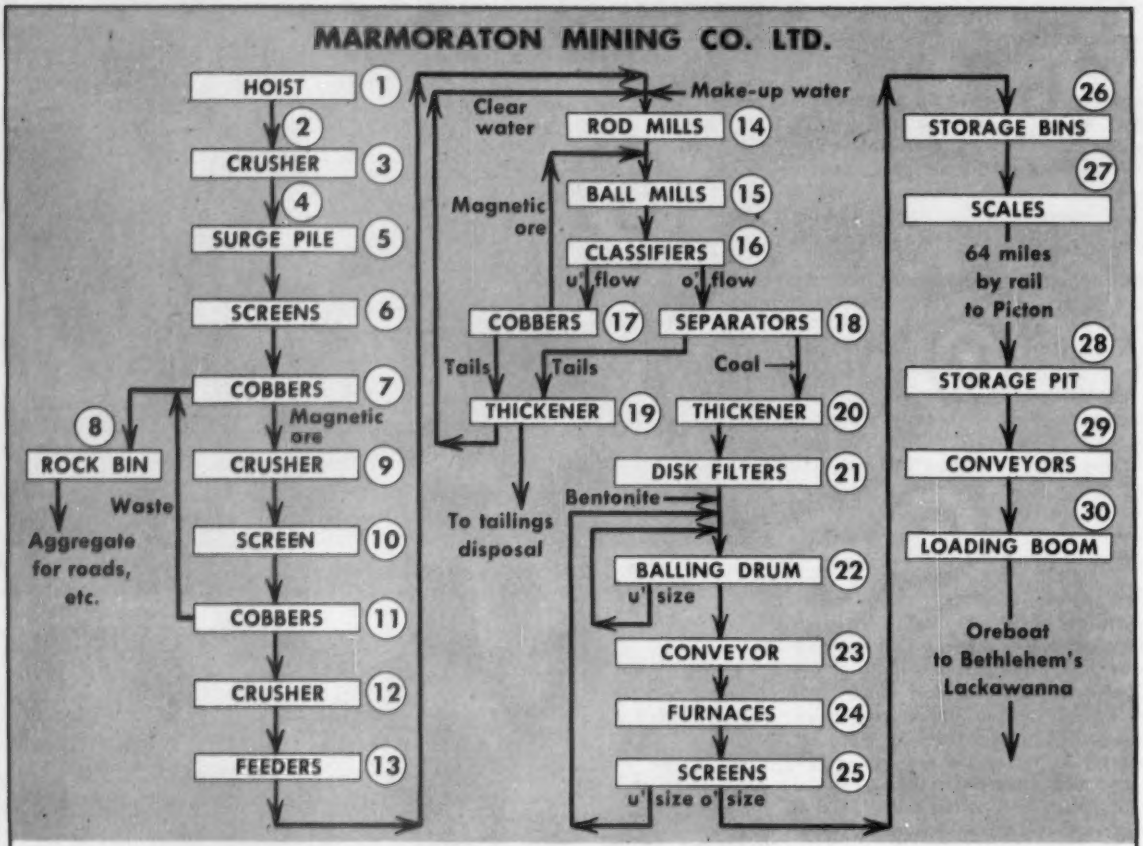
Crushing plant works on a three-shift basis. 48-in. gyratory primary crusher grinds to minus 5-in., which is conveyed to surge pile. Ore is then carried via reclaiming tunnel conveyor to triple-deck vibrating screen which sorts to four magnetic belt separators (used as cobbers in the Marmora operation).

For a simplified flowsheet of the crushing and pelletizing processes, please see page 78.

Oversize ore is then conveyed to secondary 5-ft, 6-in. crusher (providing minus 2-in.) to double deck screen; again over three magnetic cobbers; to tertiary crusher for grinding to minus ⅜-in. product, and then to two storage silos. Crushed waste rock is stored in a rock bin for use as aggregate in road building and repair.

Water is introduced before the ore is fed to one 8x12-ft rod mill in each one of two separate units and led to a 10x10½-ft ball mill, which finally provides a minus 100 mesh product.

Cone classifier receives product next in closed circuit. The classifier overflow, maintained at 95% minus 100 mesh, moves by gravity to sets of three magnetic drum separators, which produce a 65% Fe concentrate. Underflow from the cyclone is separated,



LEGEND

1. Trucks dump into hoist pocket at mine floor, 22-ton skips
2. 45-deg incline hoist, 240-ft long
3. 48-in primary gyratory crusher
4. Minus 5-in product goes by conveyor to surge piles
5. Reclaiming tunnel
6. 3-deck vibrating screens
7. 4 magnetic belt separators, used as cobbers
8. Rock bin provides crushed stone for haulage roads
9. 5-ft 6-in gyratory secondary crusher
10. 2-deck screen sizes minus 2-in product
11. 3 magnetic belt separators, used as cobbers
12. 84-in tertiary cone crusher provides ⅜-in product
13. Storage silos and feeders
14. Two 8x12-ft rod mills (coarse grind)
15. Two 10x10½-ft ball mills (minus 100 mesh)
16. Two cone classifiers (overflow maintained at 95% minus 100 mesh)
17. Two electromagnets reclaim oversize, tailings to thickener
18. Eight 3-drum magnetic separators (four for each unit produce 65% Fe)
19. 100-ft tailings thickener
20. 30-ft concentrate thickener separates water from product and anthracite culm
21. 6-ft-diameter disk filters
22. 8x16-ft balling drums with trommel 3/4-in pellets
23. Conveyor feeder on shuttle car
24. Four oil-fired furnaces, high temperature, contain small crushers to break pellet clusters
25. Screens send undersize pellets back to balling drums where they act as seed pellets
26. 400-ton capacity steel storage bins
27. Automatic weighing device
28. 800-ft-long 30-ft deep storage pit, 330,000 tons capacity
29. 42-in conveyor runs length of reclaiming tunnel, 25 chutes, 500 fpm, feeds identical 42-in conveyor, set at 90-degree angle
30. Loading boom, with 54-ft shuttle travel

with non-magnetic material going to 100-ft thickener and magnetic material reintroduced into the ball mill. Water overflow from the thickener is returned to the grinding circuit. Tailings are pumped 2,000 ft for disposal.

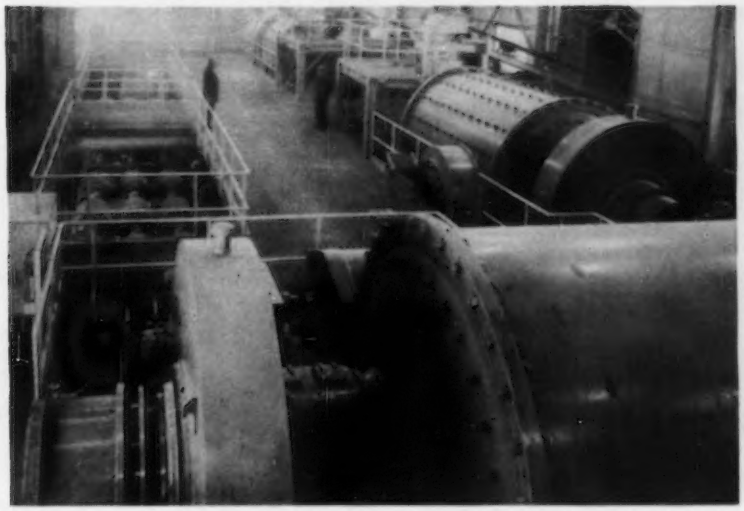
Product goes to a 30-ft thickener in the pellet plant; mixed with anthracite coal and then to 6-ft disk filters for dewatering. Product from filters is put through 8x16-ft balling drums with trommel screens after being mixed with a small amount of bentonite.

Twin-shaft oil-fired, vertical furnace, 6x6-ft 3-in. per shaft, receives ¾-in. pellets via oscillating conveyor from balling drum trommel. Undersize pellets are returned to balling drum where they act as seed pellets in the next "batch." Furnace removes 10% moisture from pellets, preheats them and finally bakes them at high heat. During the burning period considerable exothermic heat is evolved by oxidation of the magnetic constituent to form hematite. Average production will be about 1,420 tons of pellets each 24 hours for the year around.

Pellets are stored in 400-ton capacity steel bin for loading into trains for shipment to Picton.

Three of the four furnaces installed are in steady operation. Mill operators found that, through various production advances and improvements, planned capacity could be met by only three with the fourth in reserve. Dust collectors are placed at the furnace discharge and exhaust fans are set at the tops.

To break up the "clusters" of pel-



PRODUCT GOES through rod mills, ball mills, cone classifier and sets of three magnetic separators (left). Beneficiation raises 37% Fe to 65% Fe, ¾-in. pellets.

HAROLD OLSON, general superintendent (left), and Henry Visser, port foreman.

lets which form in the furnaces' intense heat, Marmora's engineers have installed unique crushers.

Small crushers consist of 6-in. wheels, set every two inches on a cross rod, with small knobs on the rims. Rims rock back and forth about one-third turn, dispersing the "bunches of grapes."

Wise equipment maintenance and safety are, as in all Bethlehem-sponsored projects, of paramount importance. Marmora's 14.8-yd trucks are equipped with torque converters, semi-automatic transmissions, gear selectors, thermostatically-controlled radiators, hydraulic assist steering, air-assist on emergency brakes, single-lever control to dump and lower box and rock ejectors on dual tires. Exhaust gases of the engines are conducted to double bottoms and sides of truck boxes to heat the boxes. Boxes are lined with abrasive-resistant steel strips ½x4-in. on 8-in. centers. Four diesel 6-yd dump trucks are used for auxiliary service.

Maintenance shop, with overhead cranes and work bays, welding and electrical shop and parts storage, are laid out for peak efficiency and economy of manpower. Typical of Marmora's assists to maintenance men is a hydraulic tire changer, designed by the mine's chief electrician. Tire changer is of welded steel tube with clamps which lifts the 1,000-lb tires, moves them up, down and side to side and even tilts them for ease in setting on the hub. A second and smaller, but equally efficient, maintenance shop has been set up at dockside at Picton.

Trucks, each of which has hauled more than 1-million tons, are driven by local men, trained by the company for safe, smooth operation with a minimum of waste motion. Maintenance shop has a steel-tube U-shaped platform, portable, which fits around front end of the trucks for easy accessability to motor parts. Another Marmora safety "gimmick" is a signal flap, attached to the top of the windshield, which drops down in the driver's line of vision when the box is raised. Thus, the driver cannot pull away before the box is down.

Biggest contributor to haulage economy is the excellent condition of roadways in and around the mine and plant. Haulage roads to the dumps are a minimum of 100 ft wide (to permit a bulldozer to travel the shoulder, two trucks to pass and a road grader to operate safely at all times) and grades do not exceed 5%. One man patrols the roads to gather the very small spillage that occurs. Dump areas and roads are surfaced with crushed limestone, obtained from a 22x36-in. portable jaw crusher. Two bulldozers and a grader maintain the roads 24 hours a day and a rubbertired 'dozer cleans around the shovels.

Use of different dumps eases road maintenance, particularly during the violent surface upheavals which mark the spring "breakup."

All buildings at Marmora are steel construction, with insulated asbestos roofs and sidings. Main repair and maintenance shop, housing machine shop, carpenter shop, truck service and garage, is 260x50 ft, with two 120x40-ft wings. All administration, repair buildings are interconnected, as are dispensary, general offices and engineering offices. (See top photo on page 76.)

Personnel at Marmora and Picton totals about 280, with only four staff members from the U. S. Some 94% of the personnel live within 12 miles of the mine. Men were hired locally and trained for their jobs.

In what has become a model practice for other mining companies, Bethlehem Steel Corp.'s Marmoraton Mining Co., Ltd., has done as much as possible to make its plant, shops, mine buildings and staff houses "fit" into the local landscape. In fact, the entire operation is notable in its neatness, efficiency and "settled" appearance.

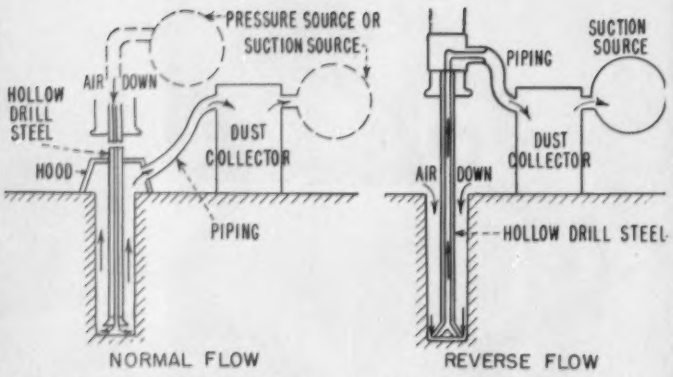
Staff houses and the company guest house at Crowe River, about 2 miles from the mine, are simple, tasteful and shaded.

Marmora Mine has brought a new economic vigor to the district. And, according to the local Marmora *Herald*, "From the first, officials and representatives of Bethlehem Steel Corp. have won the friendship and esteem of all who have come to know them."

Harold O. Olson, general superintendent at Marmora, paid tribute to the helpful and cooperative work of the mine's neighbors and to Canadian officials in a recent talk to the Canadian Institute of Mines and Metallurgy. Al Lorenson is superintendent; Gil Painshaud, plant engineer; Stanton Shaak, resident auditor; and Henry Visser is port foreman at Picton. A. F. Peterson is vice president, raw materials of the parent company.

Marmora is another bright spot in Canada's growth and prosperity. It has brought new prosperity to the village of Marmora and to Picton and played the role of "good neighbor" by taking part in many worthwhile civic projects and drives.

Courtesy Ingersoll-Rand Co.



BOTH AIR FLUSH SYSTEMS use three basic components: (1) source to move air, (2) pipe to convey air and rock particles, (3) collector for particles. In addition, normal flow system uses hood at collar to capture cuttings while reverse flow uses hole itself and hollow drill steel for same purpose.

Courtesy Goodman Mfg. Co.

Is Air Flush Drilling Better?

DR. HOWARD L. HARTMAN
Assistant Professor
Mining Engineering
Colorado School of Mines

AN INNOVATION IN DRILLING has quietly taken hold in the mining industry during the past five years, both with rotary and percussion drilling, in open pit and underground work, in metal mines and coal mines, and at home as well as abroad. This new technique uses air to flush drill cuttings instead of conventional liquids (water, foam, or muds), and usually employs a local exhaust system to control dust and collect cuttings.

Method is simple in operation but variable in design. It may function as a pressure or suction system, or a combination of both. Flow direction of the circulating air may be either normal or reverse, as distinguished in drawing above. Operating components of method are (1) a compressor or exhaust fan or ejector to move air, (2) a dust collector of settling-tank, centrifugal, or bag-filter type in one or more stages to separate cuttings and dust from air stream, (3) connecting flexible piping, and, in case of normal flow systems, (4) a hood or enclosure over mouth of drill hole to gather cuttings as they are ejected.

Air flushing should not be confused with "dry drilling," which has an unsavory reputation underground. In dry drilling, the drill operator either runs a machine with no water connection or declines to turn on the water—in neither case is fluid circulated to remove cuttings nor attempt made to control dust. Such a procedure constitutes a health hazard underground and is also undesirable for surface work. It is so recognized by law in many states.

Actually air flushing is not a new drilling practice but is a post war revival in the mining industry. Borrowed from the petroleum industry, it has gained widespread acceptance and use. Various schemes have been used with percussion drills in mining since 1895 abroad and 1905 in the United States. In replacing wet drilling, however, the method was unsuccessful until the last decade, mainly because of objections to bulky hoods and collection units formerly needed for air flushing and to firm entrenchment of wet systems.

Underground Use Fairly Recent

Several new applications of air flushing with exhaust control have been responsible for its renewed interest and use underground. Although it has been applied on a limited scale to diamond drilling for many years, mostly in ground where wet drilling has proved unsatisfactory, the impetus for application to percussion drilling was the development of the reverse-flow principle as exemplified since 1950 by several ingenious European machines. Both in Britain and on the continent, drills have been introduced which exhaust cuttings through the drill steel and eliminate the need for any hood. Improved dust collectors are also more compact, serviceable and have more capacity. Late in the 1940's, with the advent of roof bolting in coal mines of the United States, air exhaust systems were installed on both rotary and percussion bolt-hole drills and have proven successful. The extent of their use can be judged from reports of private companies and the results of a Bureau of Mines survey in 1951 which revealed that 55% of coal mines practicing dust control used air exhaust systems on bolt-hole drills.[1] In Belgium, about 33 of 58 coal mines practicing control for blast-hole drilling utilize exhaust control.

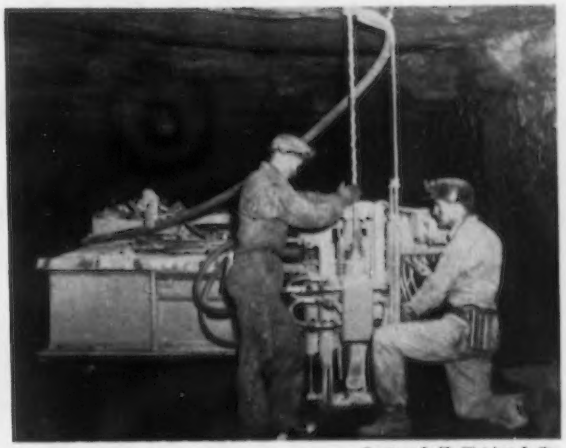
In open-pit and quarry blast-hole drilling, the big impetus for the use of air flushing came with the adaption of rotary drills with roller tri-cone bits for mining in 1946, essentially the same type rig as employed in oil-well drilling since 1901. It was not until 1949, after conventional fluids had proven unsatisfactory however, that air flushing was adopted for these rotary units; since then, it has been applied exclusively. Incidentally, it was the following year when the petroleum industry revived the use of air or gas for drilling in fractured ground; today, its acceptance is widespread.

Large piston percussion drills introduced in 1947 and the combination rotary-percussion units developed in 1952 for open-pit work, also employ air flushing with a hooded exhaust system. Churn drills are meeting with stiff competition from both rotary and percussion rigs in surface drilling of large-diameter blast holes in medium to hard rock. Several hundreds of these units are now in operation in quarries, coal strippings, and open-pit metal and non-metallic mines.

Significant advantages of air flushing over wet drilling have been established. Most important are the following:

Courtesy Cheshire Engineering Co.

REVERSE-FLOW system, later European development, revived interest in applying air flush to small percussion drills in mines.



Courtesy J. H. Fletcher & Co.

COLLAR-HOOD for rotary bolt-hole drill in coal mines, early U.S. air flush application, is improved in this unit.

1. Maximum bit performance obtained—fastest rate of penetration and longest bit life.
2. Provision of satisfactory dust control and permanent removal of dust and cuttings, possibly for use as hole stemming.
3. More suitable than water for some natural conditions and more easily obtained.
4. Highly satisfactory as bit coolant if air is expanded through jet nozzle against bit cutting surfaces.

Considerable evidence has now been accumulated that supports the first advantage named, which determines the suitability of a drilling technique from the all-important cost standpoint. Both laboratory[2,3] and field tests[4,5] demonstrate that faster, more effective hole cleaning is obtained with air because faster fluid velocities can be maintained (up to several hundred times higher) and possibly there is less abrasion and polishing. Performance with air flushing has been 10 to 25% better than with wet drilling in nearly all cases reported, and as high as 50 to 200% better in several. Because of its low viscosity, density and resulting friction loss, air has been stated to be the ideal circulating medium.[6]

There are many drilling applications where the use of water is undesirable or unsatisfactory. Such circumstances include scarcity of supply of water or difficulty in piping, work in freezing temperatures, hot humid mines where water aggravates environmental conditions, personal discomfiture to miners in being wet, roof or floor condition damaged by water, drilling in fissured rock, drilling in swelling or balling ground, or drilling to great depth. Under these conditions, air flushing is preferable to water.

Two serious limitations with air flushing are wet ground that plugs the steel or exhaust system, and sloughing ground that will cave while drilling. Reverse-flow air flushing in wet ground is nearly impossible, but with normal flow, wet cuttings can usually be handled satisfactorily. The dust collector can temporarily be disconnected to prevent clogging while drilling a wet formation. In sloughing ground, the cementing properties of a drilling mud are often necessary to keep the hole open.

Selecting and Designing System

Design of a drilling system using air for flushing of cuttings involves first the selection of the quantity of air required for circulation. Air flow must be restricted to minimum needs because operating power varies as the cube of the quantity of air flowing. Determination of the quantity of air required depends upon the calculation of a critical (minimum) transport velocity, because the problem involved is one of pneumatic conveying. The motion of large particles (under 2¼ in.) in still air obeys Newton's law. From the mathematical expression of that law can be calculated the terminal settling velocity of the largest sized drill cutting to be ejected, which then is equivalent to the critical fluid velocity needed to just support that particle in a rising air stream. Since horizontal conveying requires less fluid velocity, the critical velocity calculated for vertical conveying will suffice for any angle of drill hole.

Recent experimental work conducted on pneumatic conveying of drill cuttings demonstrates that calculated critical velocities have usually been too high. A more accurate velocity is obtained if the Newton equation is modified to include the effect of particle shape and if the fluid density is based upon the mixture of air and solid particles. The velocity thus calculated is still on the conservative side, however, due to the lifting effect of a moving stream of fine particles on the few large fragments present.

The critical velocity and air quantity required for given drilling conditions is based on the modified Newton equation[2]:

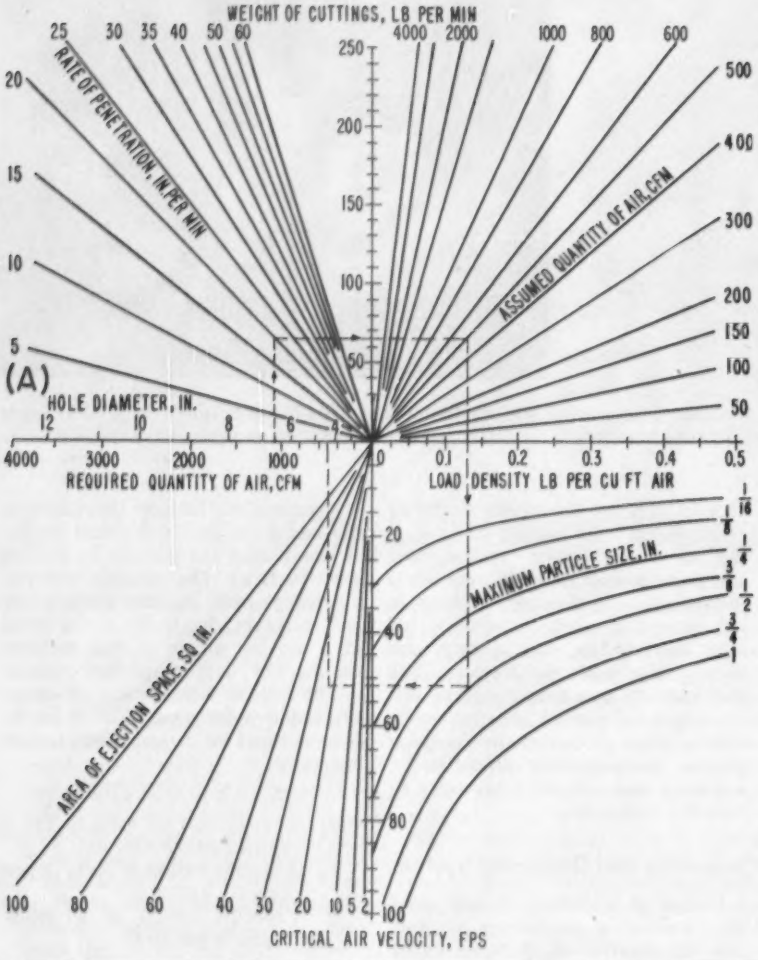
$$V = 2.56 \sqrt{d\, w_s / w}$$

where V = critical air velocity, fps
d = mean particle size, in.
w_s = specific weight of rock, lb per cu ft
w = specific weight of air-solids mix, lb per cu ft

and flow formula: $Q = 4.17\ AV$
Q = quantity of air, cfm
A = area of ejection space, sq in.

The mixture specific weight was determined by adding the specific weight of standard air (0.072 lb per cu ft) and the load density of solids conveyed in lb per cu ft of air. Rock specific weight was taken as 165 lb per cu ft (sp gr 2.64), which is correct for the average rock (quartz, granite, porphyry, sandstone, limestone, etc.). The area of the ejection space used in determining the quantity is the area of the annulus in a normal-flow system and the area of the central opening in the drill steel in a reverse-flow system. The quantity of air thus obtained is a minimum amount required and may be increased somewhat. However, the figure is a conservative one and should suffice for an occasional rock cutting even larger than that assumed. Because of smaller ejection area a smaller airflow is required for a reverse-flow system than for a normal-flow one. The reduction is considerable and may be as much as four or

How to Tell Quantity of Air Needed to Flush Quarry Blast Holes


WEIGHT OF CUTTINGS, LB PER MIN
RATE OF PENETRATION, IN. PER MIN
ASSUMED QUANTITY OF AIR, CFM
(A)
HOLE DIAMETER, IN.
REQUIRED QUANTITY OF AIR, CFM
LOAD DENSITY LB PER CU FT AIR
MAXIMUM PARTICLE SIZE, IN.
AREA OF EJECTION SPACE, SQ IN.
CRITICAL AIR VELOCITY, FPS

GRAPH SOLVES FIRST PROBLEM —how much air is needed—in designing air flush system for large holes. Based on formula given in text, similar one can be made for smaller holes. Use is as follows: Given is drill (normal-flow system) with 6⅝ in. bit, 3¾ in. steel, penetrating rate 20 in. per minute, maximum cuttings size ½ in. Start at "hole diameter" in upper left-hand quadrant (A), go up to "rate of penetration." From that point go horizontally to right to intersect an "assumed quantity of flushing air," (say 500 cfm). Drop down to intersect "maximum particle size." Then proceed horizontally to left to intersect "area of ejection space," (calculated as 23.4 sq in.). Finally go vertically up to read "required quantity of air," which is 500 cfm in this case. Since required quantity agrees with that assumed, it is correct answer. If required quantity does not agree, assumed quantity must be adjusted to fit and then tested with new solution. In addition to air quantity, "weight of cuttings" formed (65 lb per minute in this case), "load density" (0.13 lb cuttings per cu ft air), and "critical air velocity" (52 fps) can also be obtained from graph. Note that the higher the load density used, the lower the velocity and quantity of air required; only practical limit is plugging ejection space which is hardly possible within range of load densities used. Also note that smaller ejection space of reverse-flow system would make air requirement of such system much smaller. Other problems are mainly mechanical.

five times. (See graphic solution.)

Selection of equipment for the remainder of the system is mainly mechanical problem. A streamlined hood to trap cuttings at the mouth of the drill hole in a normal-flow system will result in lower pressure drop and more effective dust control. Piping connecting the hood to the dust collector should be economically sized but of such a diameter to maintain the air velocity at or slightly above the critical velocity previously determined. For separation of the cuttings from the air, two-stage dust collection is preferable. Over 90% of the coarser cuttings can be removed in the high-capacity first-stage unit, usually a settling chamber or cyclone-type separator, and the fines constituting the remainder can be removed in a second-stage bag filter, when dust control needs to be practiced.

In conclusion, it should be emphasized that air flushing for rock drilling, while not a panacea, has resulted in faster, lower-cost drilling in most instances were tried. Air has many advantages over water for flushing and is proving highly satisfactory for nearly all drilling applications in the mining industry.

Courtesy Bucyrus-Erie Co.

QUANTITY OF FLUSHING AIR needed by large rotary drill of this type can be determined graphically above.

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How Bunker Hill Blends Charge For Better Lead Smelting

RATHER THAN MAKE EXTENSIVE REPAIRS, improvements and replacements in their sample mill, storage and charge preparation facilities after World War II, Bunker Hill & Sullivan Mining & Concentrating Co. decided on an entirely new preparation plant. Cost estimate of rebuilding the old plant at Kellogg, Idaho, favored this new idea in charge preparation.

According to P. C. Feddersen, general manager, prime consideration in the design was given to: (1) Positive pre-charge control of all ingredients, and (2) blending for proper chemical and physical properties to provide maximum sintering and smelting capacity. Research and pilot plant operations demonstrated that the foregoing objectives could be most nearly obtained by: (a) An all weather receiving and storage system; (b) crushing all ingredients to minus ¼ in.; (c) bins with positive feed for many irregular materials; (d) adequate blending; (e) delay bedding for assay control; and (f) pelletizing for speedy sintering.

Construction of the new plant was started in late 1951 and completed in October 1953 by Stearns-Roger Mfg. Co., Denver. Regular smelter operations were not interrupted. Capital outlay was $2.5-million. It is one of the most modern plants of its kind in existence and performance has met and promises to exceed expectations. Plant contains four separate operating units—crushing, proportioning, bedding and pelletizing, all under the watchful eye of Glenn Blickensderfer, plant superintendent. Units contain the latest in ore dressing, control and safety equipment. Buildings are well-ventilated steel frame with asbestos siding and are heated in winter. Dust recovery units at strategic points reduce dust hazard to a minimum.

APRON FEEDERS ON STEEL HOPPERS send material from proportioning plant to impactor where lumps are broken and charge thoroughly mixed and blended.

Crushing Plant

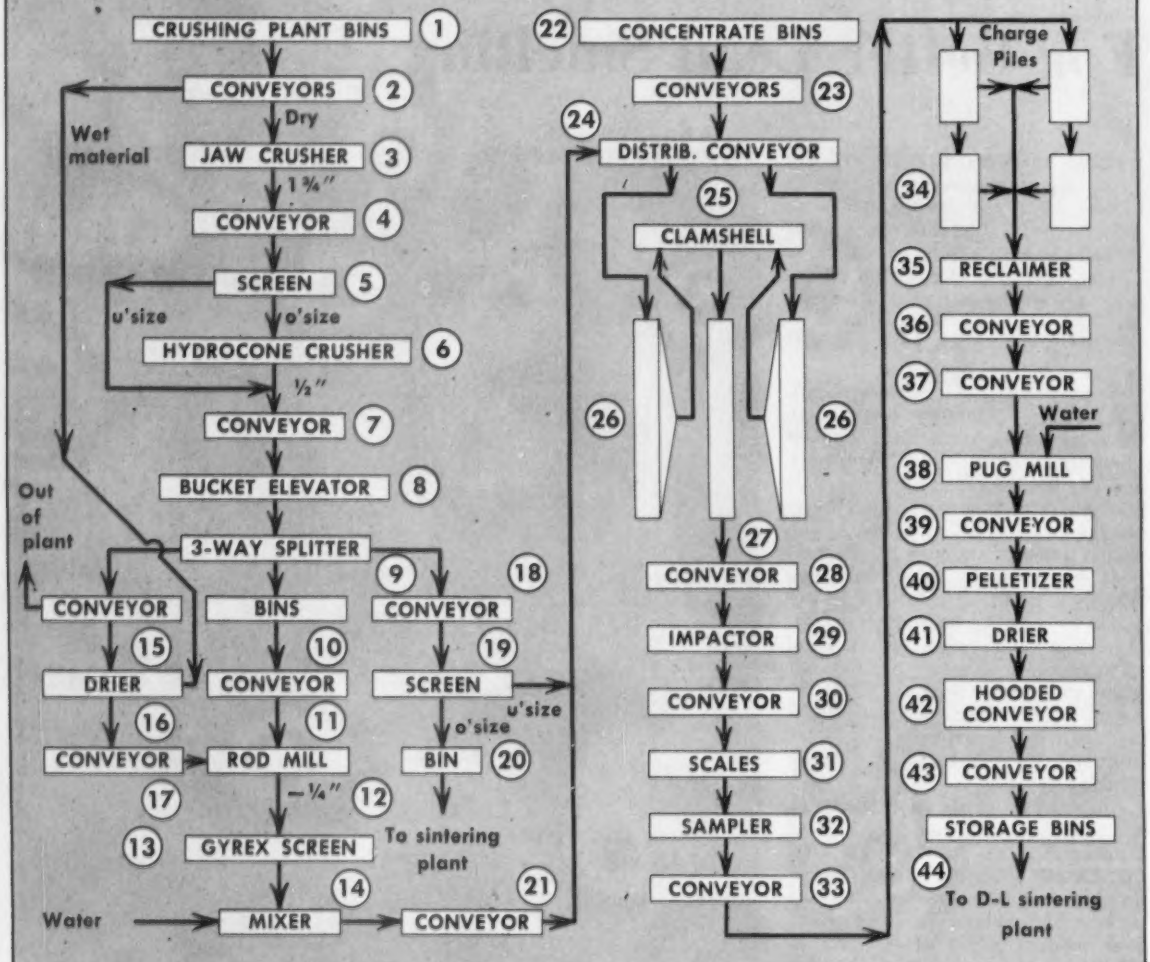
Materials are received in 27 bins (2600 cu ft) serviced by railroad cars overhead and by conveyors below. Ten of the storage bins hold lead concentrate which is belt conveyed to corresponding storage bin in proportioning plant. Seven bins hold residues, by-product fumes, dust and other concentrates which do not need crushing and these go by conveyor to the proper bin in the proportioning plant. Remaining ten bins store lime rock, return dump slag, return sinter, crude ore, silica flux and smelter by-products such as Cottrell and antimonial materials which must go to the crusher.

J. D. Taylor, crusher foreman, uses two-stage crushing and dry rod milling to reduce the coarse material to minus ¼ in. Equipment includes a 24x36-in. Traylor Type H jaw crusher (2½ in. open—1¾ in. closed); No. 648 Allis-Chalmers Hydrocone crusher in open circuit with a 4x8-ft Allis-Chalmers rod deck screen with ¾ in. opening; and a 9x12-ft Allis-Chalmers peripheral discharge rod mill operating at 16.5 rpm. Periodic additions of 3¼-in. steel rods maintain the 30-ton charge in the rod mill. Maximum moisture allowed at rod mill is about 2%. An oil-fired Stearns-Roger 8x60-ft rotary drier at 4.45 rpm on 75-hp is used to dry the rod mill feed when necessary. Rod mill discharge passes to a 36x54-in. Robins Gyrex 1 mesh screen for scalping out broken rods and then to a 12-ft long and 3-ft 11-in. wide Jeffrey double paddle mixer where wetting reduces dusting before it goes by belt conveyor to proportioning plant.

Ahead of the rod mill are two steel bins (12 ft diameter) 17½-ft high which receive secondary crusher-screen products via a 77-ft Jeffrey continuous bucket elevator. Elevator

CHARGE PREPARATION PLANT

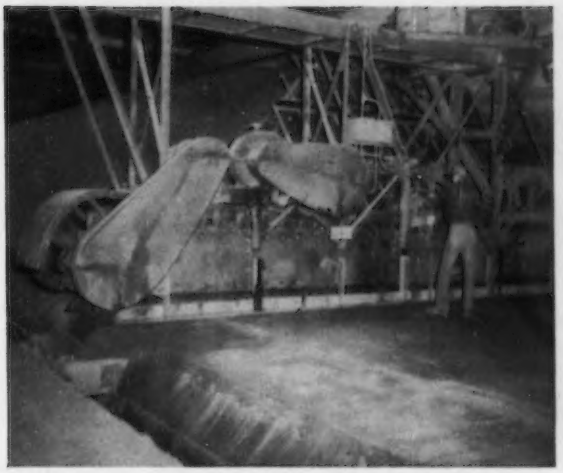
Bunker Hill & Sullivan Mining & Concentrating Co., Kellogg, Idaho



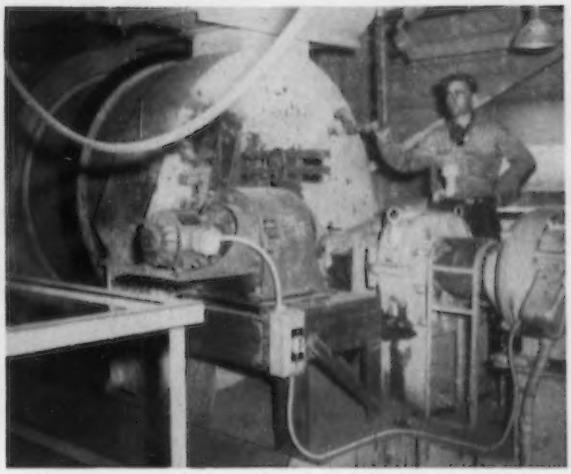
LEGEND

1. Bins for coarse wet and dry material
2. Belt conveyor system, Hewitt-Robins 30-in. and 24-in. belts
3. Traylor 24x36-in. jaw crusher
4. 24-in. H-R belt conveyor*
5. Allis-Chalmers 4x8-ft. rod deck screen, 1¾-in. openings
6. Allis-Chalmers No. 648 Hydrocone crusher
7. 16-in. H-R belt conveyor
8. Jeffrey bucket elevator, 77 ft. high
9. 3-way splitter
10. Two 12x17½-ft. circular steel storage bins
11. 16-in. H-R conveyor
12. Allis-Chalmers 9x12 rod mill
13. Robins Gyrex Screen, one mesh
14. Jeffrey double paddle mixer
15. 16-in. H-R reversible belt conveyor
16. 8x60-ft. Stearns-Roger rotary drier
17. 24-in. H-R belt conveyor
18. 16-in. H-R belt conveyor
19. 4x8-ft. Symons Roddeck screen ¼ in., for sinter
20. Sinter pallet dressing storage bin
21. 16-in. H-R belt conveyor
22. Bins for concentrates and fine materials
23. Belt conveyor system, 30-in. and 24-in. belts
24. 16-in. H-R distribution belt with trippers
25. P&H overhead crane with 2-yd. Blaw-Knox clamshell bucket
26. 11 concrete storage bins for crushing plant products
    8 concrete bins for concentrates and fines
27. 19 steel hopper-bottom proportioning bins
28. Belt conveyor system with 30-in. H-R belts
29. Pennsylvania reversible crusher
30. Belt conveyor system with 30-in. H-R belts
31. Merrick Weightometer and Rateograph
32. Bucket sampler
33. 24-in. H-R belt conveyor
34. Four 900-ton piles
35. Mechanical reclaimer
36. 30-in. H-R belt conveyor, gathering belt
37. 24-in. H-R belt conveyor
38. American Ore Reduction pug mill
39. 24-in. H-R belt conveyor
40. 8x15-ft. Stearns-Roger pelletizing drum
41. 7x30-ft. Stearns-Roger rotary drier
42. Two H-R 30-in. belt conveyors
43. 24-in. H-R belt conveyor
44. Two 350-ton pellet storage bins

*All belt conveyors are Hewitt-Robins and labeled H-R here



RECLAIMER moves piles into sublevel conveyor in the bedding plant after assay corrections have been made to each pile.



PELLETIZING in an 8x15-ft drum yields pellets that make for free flowing and porous smelter charge in the lead furnace.

discharges into a three way splitter. Splitter can feed to a reversible belt serving either a belt going to the drier or one going out of the plant; or to the storage bins below and then to the rod mill; or return sinter to a 4x8-ft Symons Roddeck ¼-in. screen. Undersize from this screen goes to the proportioning plant and oversize goes to sintering plant pallet dressing storage bin. Oversize is used to dilute the sulphur content in the proportioning plant.

Belt conveyor system in all the plants is designed to give maximum flexibility and balanced flow rates. All belts are interlocked and have electromagnets at strategic points to remove tramp iron. Conveyor system permits routing materials to the crusher units and then directly to railroad cars; or to proper bins at the proportioning plant; to crusher units and then to the two steel bins and the rod mill; to the crushers and to drier or rod mill; to crushers and then to sinter screen; or directly from storage bins outside of crushing plant to drier. Plant is normally operated on 3-shift basis.

Proportioning Plant

Proportioning plant building is nearly a city block long. On the east side 11 concrete bins provide storage space for crushed materials. On the west side 8 bins store concentrates and fine materials not requiring reduction. West side bins have a capacity of 6,000 cu ft. Six of the east side bins hold 3,600 cu ft and the other five hold 7,200 cu ft. Between these two rows of bins are 19 steel hopper-bins (1,000 cu ft) each feeding from one of the 19 concrete bins. Steel rail grizzly with spacing from 6 to 18 in., depending on the material, covers the top of the 19 hoppers. Blaw-Knox 2-yd clamshell operated from a P&H overhead crane, dumps material from each concrete bin into the proper steel hopper.

Ingredients in the steel hoppers are withdrawn by mechanical feeders onto a 30-in. gathering belt running the entire length of the hoppers. Gathering belt feeds a 30-in. cross belt leading to the impactor at the head of the bedding plant. Cross belt has electromagnet for tramp iron. Eighteen hoppers have 4x8-ft apron feeders—12 are variable-speed drive—6 are ratchet drive. Two-thirds of the flux is added to this cross belt en route to the impactor. Each ingredient is fed onto the belt at a rate determined by the current rate of receipts. Feed rate to the bedding plant is 180 to 200 tons per hour.

Impactor, designed to break lumps, blend and mix the charge, is a Pennsylvania, size CF-7-38 reversible unit driven by 200 hp at 880 rpm. Product from the impactor goes by belt over a Merrick Model E Weightometer and Rateograph to an automatic bucket sampler and then to the bedding plant. Proportioning plant runs on a one shift basis.

Bedding Plant

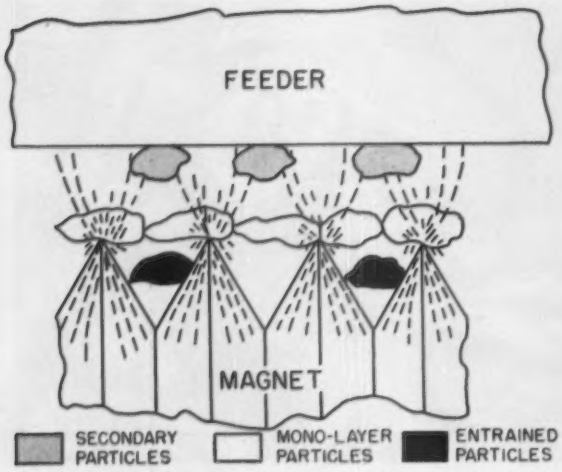
After a bedding pile has been completed and an analysis obtained, D. F. Ingvoldstad, superintendent of metallurgy, and his staff calculate the flux addition required to correct the pile composition. Each pile is not only corrected to give the desired slag composition, but to give the desired sulphur content in the pellets and the desired lead fall at the blast furnace.

Bedding plant floor is large enough to hold four 900-ton piles. Collecting belt, operating sublevel in a central trench, divides the bedding plant longitudinally. Piles are successively removed into the collecting trench by a reclaimer, designed by Stearns-Roger and Bunker Hill, which operates from an overhead rail. Rail swings in an orbit above the trench. Reclaimer is an inclined manifold of rakes, that cuts representative slices off the exposed pile; and a drag conveyor that shoves material into the trench. Forward movement into the pile is intermittent and is controlled by a paddle connected to a switch resting on the toe of the bedding pile. Collecting conveyor moves material into the pelletizing plant.

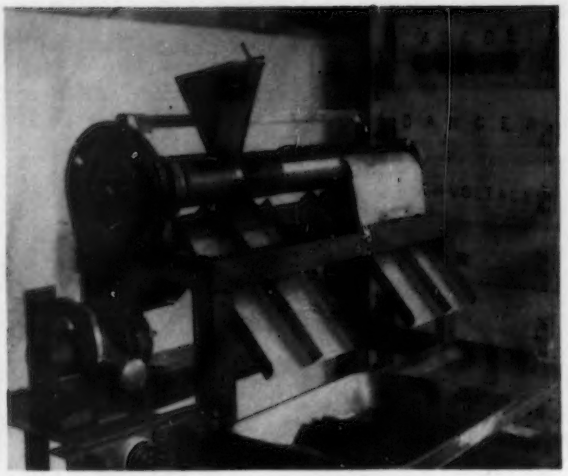
Pelletizing Plant

At the pelletizing plant a surge bin holds the material for the pug mill. Material goes from the bin into a 5x7-ft American Ore Reduction pug mill at 100 tons per hour. Water to give the required moisture content for pelletization is added by valve-operated flow meters located at the discharge end of the pelletizer. Pelletizer is an 8x15-ft drum turning at 10.5 rpm. Stationed at the discharge end of the pelletizer, the operator can watch and control the size and character of the pellets. Fresh pellets are surface hardened in a 7x30-ft oil-fired rotary drier operating at 11.3 rpm. Hardened pellets discharge onto two hooded belts for steam removal and cooling; another belt stores the pellets in two 350-ton bins near the Dwight-Lloyd sintering ovens. Pellets go by belt to the sintering ovens.

Many operating improvements were made during the initial start-up of this new concept in charge preparation. Plant continues to run at high capacity under uniform controls set up by Harold E. Lee, smelter general superintendent and George W. Dunn, superintendent of operations.



SKETCH. MONO-LAYER is accepted by peaks of magnetic intensity while secondary particles pass untouched.



FOUR AREAS OF ATTRACTION with winding in the center of magnet are visible on this stripped-down test model.

Novel Design Permits Selective Magnetic Separation

NOVEL IN DESIGN and selective in action, Titanium Corp's. newly developed magnetic separator has been producing high purity ilmenite concentrate for the past year at Natal, South Africa. Theodore Perlman, managing director of the Ilmenite Hill property, patented the machine; claiming higher feed rates, higher recovery and unusually high concentration in comparison with conventional separators. Selective for ilmenite and currently producing 60,000 tons ilmenite a year this magnetic separator plant has an estimated 156,000 tons a year capacity. Added features of the invention: Low operating costs, low electrical requirements and economy of floor space.

Success of the separator hinges on the surface design of the magnetic roll. Surface is described as being scabrous—meaning that the roll, in the area of magnetic concentration, has a surface much like a rat-tail file. Surface can be a simple screw thread (similar to the front of the file) or a screw thread with parallel cuts made fore and aft on the roll (back of the file). Peaks and valleys formed by this tooling are the most significant feature of the patent. Pitch and depth of the cut surface vary with the mesh and/or the magnetic susceptibility of the ore particle being collected.

LESS FLOOR SPACE is needed to set up the 156,000 ton per year plant.

Operating Principle

In operation, the magnetic field produced by the applied emf concentrates at the peaks on the cut surface. Little or no magnetism develops in the valleys. This pin-point concentration causes the magnet to work on a mono-layer of incoming ore particles and causes the magnet to accept only those ilmenite particles for which the cut surface was designed (sketch). Ilmenite of smaller mesh and/or different magnetic susceptibility as well as ilmenite in the secondary layers of the incoming feed pass on to the next magnet. Ore particles falling in the valleys are thrown back into the outgoing feed stream by the centrifugal action of the rotating magnet. Release of entrained particles from the valleys is due to the lack of magnetic concentration in the valleys and accounts for the small amount of gangue reporting in the ilmenite concentrate. Ilmenite particles accepted by the magnet are

brushed off the back of the magnet and into the concentrate launder.

Roll Design

A magnetic roll may contain one or more areas of attraction and at least one area of applied emf. Brushes run in the channels on the rotating magnet and connect with the power supply. Magnet may be a solid rod with the winding in the center. Areas of attraction may be tooled into the solid rod or into a sleeve to be pressed on the rod. Four rules of thumb are suggested by the inventor as guides in determining pitch and depth of the thread cut:

1. Pitch in excess of that required to collect a given particle size results in the gangue entrainment in the concentrate.
2. Pitch less than particle size requirements can cause high tailing losses.
3. Shallow thread and fine pitch are necessary if the particles are readily susceptible.
4. Deep thread and coarse pitch are necessary on weakly susceptible material.

Two rolls operate as a magnetic set. Both rolls are tooled to accept the same type of particle. Both rolls, turned by the same belt, rotate toward each other and down into the incoming feed stream which falls between the rolls.

Ten of these magnetic sets are stacked one upon the other so that the tails of one become the heads of the next lower set. Each set in the stacked unit is specially tooled by trial and error to accept the desired particle size and/or magnetic susceptibility. By the time the feed stream has passed through the bottom magnetic set all ilmenite has been removed. Tailings from the magnetic unit are sent to the electrostatic separators for zircon and rutile recovery. Each 10-set unit is powered by the same motor.

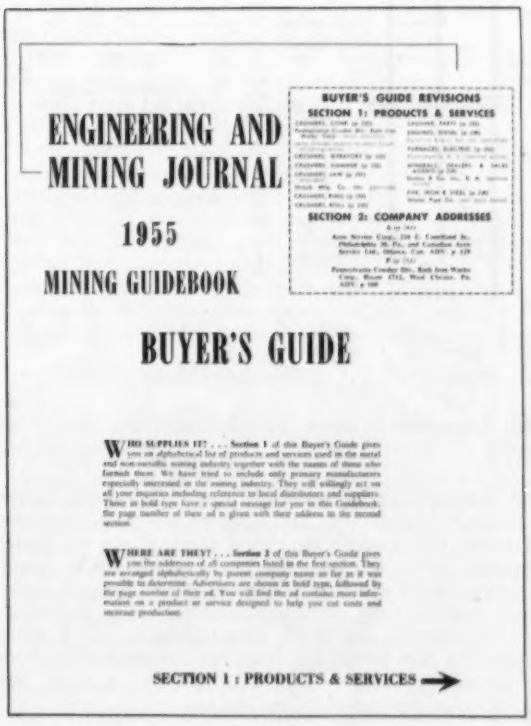
Order of removal, exact tooling vs. mesh, amount and type of winding, emf applied, roll speed and feed rates have been omitted from the patent. These items would have to be worked out, by trial and error, for any particular combination of mineral and ore.

Titanium Corp. is producing high grade ilmenite with ten 10-set units. Tailings from the magnetic plant are yielding 6,000 tons zircon and 3,500 tons rutile a year in the electrostatic plant. Ilmenite recovery is claimed to be 100% and rutile recovery 97%.

Mine and Mill Site

Mine operations are essentially the process of licking off a silver spoon. Ilmenite Hill has a 30-year supply of ore blocked out. Agglomerate, running 24% heavies, is dumped by dragline into steel tanks at the bottom of the hill. Sea water is added to produce the slurry for the 72 Humphreys spirals. Tailings from the spirals go down to sea; while the heavies are washed with fresh water, dried and sent to the magnets. National highway and a railroad running through the property, between the slurry tanks and the mill buildings, make shipping easy.

Revisions to Your Mid-March Mining Guidebook Buyer's Guide


ENGINEERING AND MINING JOURNAL

1955

MINING GUIDEBOOK

BUYER'S GUIDE

BUYER'S GUIDE REVISIONS
SECTION 1: PRODUCTS & SERVICES
SECTION 2: COMPANY ADDRESSES

WHO SUPPLIES IT? . . . Section 1 of this Buyer's Guide gives you an alphabetical list of products and services used in the metal and non-metallic mining industry together with the names of those who furnish them. We have tried to include only primary manufacturers especially interested in the mining industry. They will willingly act on all your inquiries including reference to local distributors and suppliers. Those in bold type have a special message for you in this Guidebook. The page number of their ad is given with their address in the second section.

WHERE ARE THEY? . . . Section 2 of this Buyer's Guide gives you the addresses of all companies listed in the first section. They are arranged alphabetically by parent company name as far as it was possible to determine. Advertisers are shown in bold type, followed by the page number of their ad. You will find the ad contains more information on a product or service designed to help you cut costs and increase production.

SECTION 1 : PRODUCTS & SERVICES →

BUYER'S GUIDE REVISIONS

SECTION 1: PRODUCTS & SERVICES

CRUSHERS, CONE (p 232)
Pennsylvania Crusher Div., Bath Iron Works Corp. (title inverted)
same change applies to other Crusher listings below:
CRUSHERS, GYRATORY (p 232)
CRUSHERS, HAMMER (p 232)
CRUSHERS, JAW (p 232)
also add:
Straub Mfg. Co. Inc. (omitted)
CRUSHERS, RING (p 233)
CRUSHERS, ROLL (p 233)
CRUSHER, PARTS (p 233)
ENGINES, DIESEL (p 234)
Cummins Engine Co. Inc. (omitted)
FURNACES, ELECTRIC (p 236)
Elektrokemisk A. S. (spelled wrong)
MINERALS, DEALERS & SALES AGENTS (p 238)
Godoy & Co. Inc., E. A. (spelled wrong)
PIPE, IRON & STEEL (p 238)
Naylor Pipe Co. (not bold faced)

SECTION 2: COMPANY ADDRESSES

A (p 244)

Aero Service Corp., 210 E. Courtland St., Philadelphia 20, Pa., and Canadian Aero Service Ltd., Ottawa, Can. ADV. p 129

P (p 254)

Pennsylvania Crusher Div., Bath Iron Works Corp., Room 1712, West Chester, Pa. ADV. p 160

Cut This Out and Paste it in Your Mid-March Mining Guidebook on First Page of BUYER'S GUIDE, Page 227, as Shown at Left

LISTED ABOVE ARE REVISIONS that should be made in the *E&MJ* Mid-March 1955 Mining Guidebook Buyer's Guide. Simplest way is to cut along dotted lines and paste on cover page of Guide.

How To Protect Crusher Motors Against Operating Hazards

H. A. WRIGHT, Assistant Manager of Sales,
Control Department,
Allis-Chalmers Manufacturing Co.
THAD F. BELLINGER, Engineer,
Control Department,
Allis-Chalmers Manufacturing Co.

MOTORS DRIVING ROCK CRUSHERS are subjected to operating hazards for which adequate protection normally is not obtained from standard commercial motor controllers. The problem of protecting crusher motors is complex because of high inertia and extreme fluctuating load characteristic.

Starting Protection

Jaw, hammer mill and roll crusher drive motors must be protected against overheating while being accelerated to operating speeds. Although none of these types can be started while loaded, friction and inertia of the crushers places an extremely heavy burden on the motors. The friction load is so great on starting that the temperature may determine whether the crusher will break away and accelerate or remain stalled. If the crusher fails to start, the flywheel may be jacked to decrease starting friction or a larger motor may be used. A much larger motor rating than that needed to run the crusher would be required to overcome all starting conditions, but going to larger ratings is usually not done.

The user normally lives with the breakaway problem, for it does not occur frequently. However, when it does occur, the operator jogs the motor repeatedly in an attempt to breakaway and jacks the flywheel only as the last resort. This type of service is not recommended by motor and control manufacturers, but is demanded and justified in the operation of a crushing plant. Since such a heavy burden is required, the motor should be protected as closely as operating requirements will allow.

On some large crushers the flywheel and rotating parts weigh 25 tons or more and several minutes may be required to accelerate the crusher to full speed. Because of the high values of torque and long accelerating period required for starting the flywheel class of crushers, wound-rotor motors are usually employed as driving motors. Motors are started with a bank of resistance in steps as the motor accelerates until the entire resistance is shorted on the last step when the motor will run at full speed. Each value of secondary resistance provides a different speed torque characteristic which allows the motor to accelerate smoothly through a series of maximum torque speed points. Value of starting current can be controlled to some extent by using various classes of starting resistors. Starting currents usually are not held below 200% of full-load current, because starting torque would be inadequate if the currents were held to lower values. Certain application factors will permit the use of high torque NEMA design C squirrel-cage induction motors for crusher drives. Crushers having high inertia characteristics cannot be started with rock in them. Material should not be fed into the crusher until it is up to speed.

How to Protect Against Overheating

Long periods of accelerating time, during which the motor carries overload current, presents a problem in protecting the motor from overheating. The crusher must be brought up to speed by the motor even though the motor may be at maximum temperature when full-load speed is reached. Overload relays will often operate to shut down the motor before full speed or maximum temperature is reached. In order to prevent the motor from tripping on starting, the user often replaces the correct heater elements furnished in the thermal overload relays with the next larger rating of elements in succession until a size of heaters is found that will permit the motor to bring the crusher up to speed. Sometimes the heater elements are completely jumpered out to render the overload relays inoperative. The use of larger heater elements does appear to be a reasonable approach, but running protection, stalled rotor protection and open-phase protection are greatly reduced. However, adequate overload protection is still possible. A simple method is shown in Fig. 1.

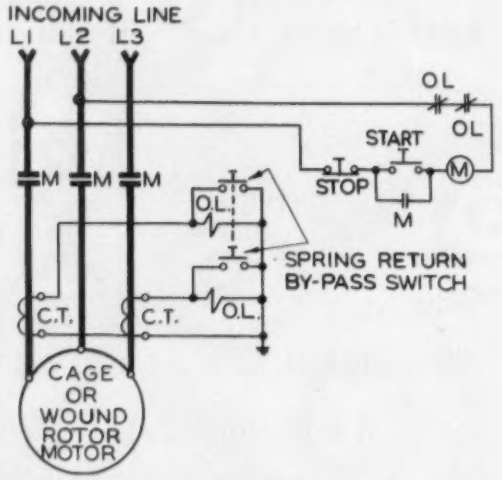


FIG. 1. Standard ac motor controller circuit with manual bypassing of thermal relays to prevent tripping on starting.

A manually or automatically operated shorting switch is connected in parallel with each of the overload heater elements. The contacts are closed to shunt out the heater elements during starting until the motor is up to speed. A spring return switch should be used with manual operation so the shorting contacts cannot be left in the closed position. Shorting out of the heater elements has a disadvantage in that protection from too frequent starting of the motor is not provided, but adequate running and stalled rotor protection is maintained.

How to Protect Against Too Many Starts

A method of providing protection from too frequent starting as well as running and stalled overload conditions

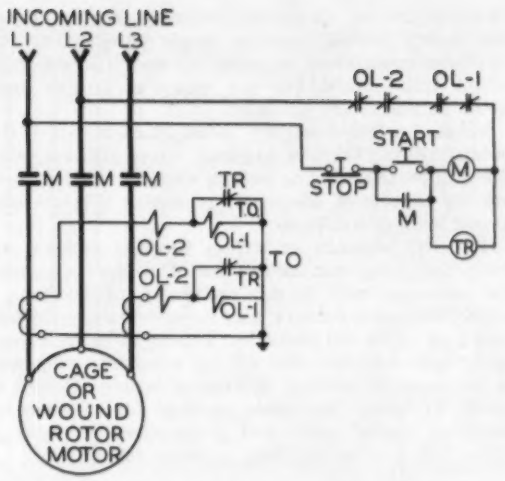


FIG. 2. Circuit for a squirrel-cage motor or wound rotor primary control with two sets of overload relays. Relays OL-1 are shorted through a time delay by contacts of timing relay TR to prevent tripping on long time starts. Overload relays OL-2 protect against excessive starting.

is shown in Fig. 2. A second set of overload relays with heaters is selected on basis of starting current, as normal currents are used in addition to the usual overload relays. Heater elements of the running overload relays are automatically shorted by contacts of a timing relay until the motor has time to reach full speed. The added set of overload relays have heaters selected with higher ratings than normal. These allow a longer tripping time to permit the motor to reach speed but shut down the motor if full speed has not been reached within a safe interval. The relays also protect from too frequent starting.

Thermal overload relays tend to over-protect the motor during acceleration by continuing to operate for several seconds after the motor has reached rated speed, although the current may be well below the rated value. This is due to thermal lag or heat inertia of the relay. Overload starting current brings the temperature of the relay mechanism up to operating temperature. The relay will continue to trip after the motor current has decreased because of the heat held by the relay parts. For this reason, only about 50 to 75% of the tripping time characteristic can be utilized, and the relay trips before the motor reaches maximum allowable temperature. Fig. 3 shows a typical operating curve of a thermal overload relay.

How to Extend Relay Tripping Time

Several ways of extending tripping time of overload relays are possible. Saturating reactors are available for use with certain types of thermal relays. Reactors are constructed with calibrated air gaps and are applied in such a manner that the reactor iron becomes saturated on values of about 200% full-load current and above. They act as a partial short circuit across relay heater elements. As the current falls below this point, the iron is unsaturated and the reactor impedance becomes large compared to that of the heater elements. In this way the overload relay operating characteristics are extended on starting currents. Reactors shunt about 2% of the current from the heaters during normal operation, which produces a negligible error into the relay operating characteristics. Use of saturating reactors does sacrifice some protection from frequent starting and stalled rotor conditions by increasing the tripping time for heavy overload currents. Fig. 4 shows saturating reactors connected in parallel with the thermal overload heater elements. (*Please turn page*)

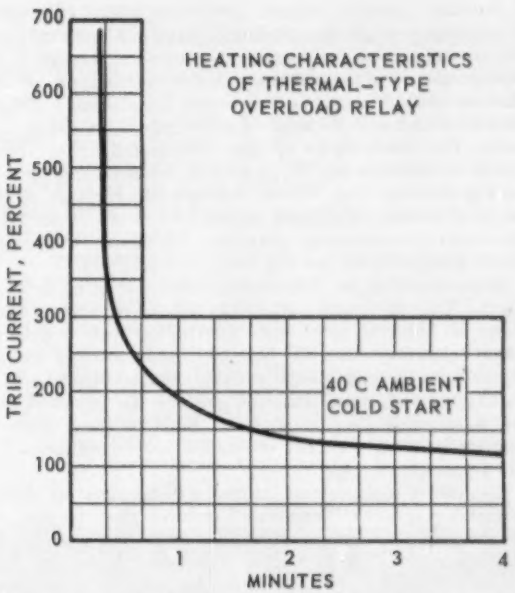


FIG. 3. This relay automatically compensates for variations in ambient temperatures to provide for closer motor protection and to prevent false operations due to ambient variations.

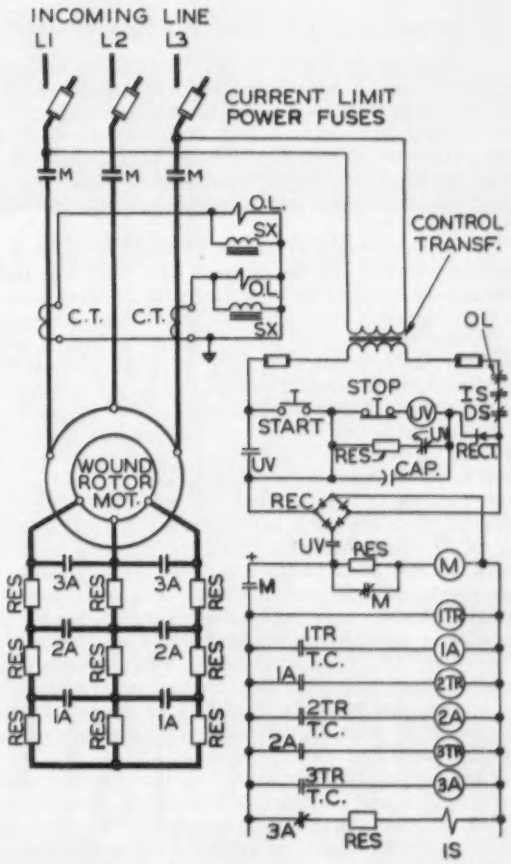


FIG. 4. Circuit for automatic wound rotor motor controller with 250,000 kva interrupting capacity. This circuit is designed to extend tripping time of thermal overload relays.

Another method utilizes saturation effect of current transformers when the overload relays are operated from the secondaries of the current transformers. Ratings of the transformers and the heater element burdens are so selected that on starting currents the current transformers become saturated and will not deliver proportional secondary currents. The transformers operate unsaturated below 150 to 200% of full-load current to provide normal running overload protection. This method has the disadvantage in that other protective relays and meters cannot be connected in the current transformer secondary circuits as well as the disadvantages listed for the saturating reactors.

Other methods for obtaining increased tripping time use special thermal relays and heater elements. Some special types of bi-metal relays are constructed with double bi-metal operating elements. Some manufacturers of melting alloy type thermal relays provide heater elements with various time characteristics obtained by use of alloys having different melting coefficients. Both of these methods provide protection except on stalled rotor conditions and too frequent startings.

Saturating reactors and current transformers, or double bi-metal relays, or "long-time" melting alloy heaters are suitable for preventing unnecessary relay operation on the starting of most crushers. Due to the heat lag of the thermal relays, tripping time in most cases cannot be increased more than 200% of normal. This increase may be enough to permit successful starting of small crushers but may not be sufficient for large crushers where the accelerating time may be as long as several minutes. In these cases the shorting-out method should be used.

Overload Protection for Fluctuating Loads

Although the starting up of heavy inertia machines such as jaw, roll and hammermill types of crushers does create an over-temperature protection problem, protection during normal operation usually creates no uncommon problems. These types of crushers are normally feeder loaded. A flywheel assists the motors on the peak loads. For these reasons the running loads are reasonably constant, with minor load fluctuations.

On gyratory types of crushers, normally there is no starting problem, for the crushers have very low inertia and are not intended to be started with crushing material in their chambers. Starting crushers with load, however, is a practice that is often abused. Motors driving gyratory crushers used as primary crushers cannot be protected from overheating with standard overload protective devices, due to the extreme fluctuating characteristics of the load.

The crushing material may be dumped into the crusher in loads varying from 5 to 20 tons. The finer material will drop to the bottom of the crushing chamber and will require from 60 to 90% of the motor horsepower output. In addition, there may be a number of pieces varying in size up to 40 in. in diameter. When the crushing head first begins to bite these pieces and simultaneously crush the fine pieces, peak momentary loads of 150 to 200% of rated horsepower may be required, although the average horsepower requirements to crush the entire load may be from 50 to 75% of the motor rating. When running empty or lightly loaded, as is the normal condition between loads, the crusher may pull only 20 to 30% of the motor rating. The extremely wide fluctuations make adequate over-temperature protection very difficult.

It may appear from the aforegoing that overload protection is not necessary because for about 90% of the crushing period the motor is operating between 50 to 75% rated output. Normally motor temperatures are well below safe limits and the short duration of the peak loading will not raise the temperature above the maximum limits. However, the purpose of a protective device is to handle the unusual conditions and not the normal conditions. A piece of tramp iron, heavy loading, packing, single phasing and other conditions could result in motor burnout if overload protection were omitted. For this reason all crusher motors should be adequately protected.

Standard motor controllers usually include two or three thermal relays. Thermal overload relays are designed to follow approximately the heating cycle of the motor. Relays are capable of adequately protecting a motor under normal loading conditions.

However, adequate protection becomes difficult on a highly fluctuating load such as that of the gyratory crusher. The safest approach to this problem is to determine by actual tests that the motor does not overheat during maximum load cycles and then select a rating of heater elements for the overload relays that will trip when over-temperature on the motor is reached. Ratings of heaters selected will usually be larger than those required for a steady load condition. Stalled rotor and single-phase protection of course will thus be sacrificed to some extent.

Over-Temperature Protection Within the Motor

Over-temperature protection for a motor is not always possible with conventional overload devices. The most logical place to determine if the motor is overheating is in the motor itself.

Two methods are used for determining the temperature of a motor winding. Temperature detectors in the form of resistance strips are placed in various stator slots between adjacent coils. Leads from these resistance elements are brought out to a Wheatstone bridge type of instrument which will indicate the temperature at each element directly. The detector also can be used with a bridge-type relay, which will operate at predetermined temperature to shut down the motor or sound an alarm. As such equipment cannot be obtained in all ratings and associated auxiliaries are expensive. Installation of a temperature detecting system of this type is warranted only on large motors and generators.

A simple form of temperature detection inside a motor is obtained by embedding small calibrated disk-type thermostat switches between the coils in the stator slots. Contacts of these switches can be used to sound alarms or shut down the motor. Most motors can be equipped with these thermostat devices. Thermostat switches built within the stators of motors are best. These devices follow heating of the motor coils closely, although there is some time lag through the insulation of windings. Thus thermostat switches may not prove adequate for high overload currents such as locked-rotor current. Major disadvantage of these devices is that from one-half to several hours may be required for the motor to cool sufficiently for the thermostats to reset once they have operated to stop the motor. Such delays cannot be tolerated. A possible solution would be to bypass the switch contacts to allow the motor to run at no load after the thermostat switches had operated to stop the motor. This would provide faster cooling to allow shorter reset time for the switches.

A more logical application of thermostat switches placed within motor windings may be to employ two sets of switches in each motor. One set would have an operating temperature at full-load temperature and the other a setting at some higher temperature. The first set to operate would sound an alarm to inform the operator that an overload condition is being approached. The operator can decrease the crusher loading until the motor cools to a safe temperature. If, however, loading cannot be decreased and the motor should reach over-temperature, the second set of switches would operate to stop the motor. Fig. 5 shows

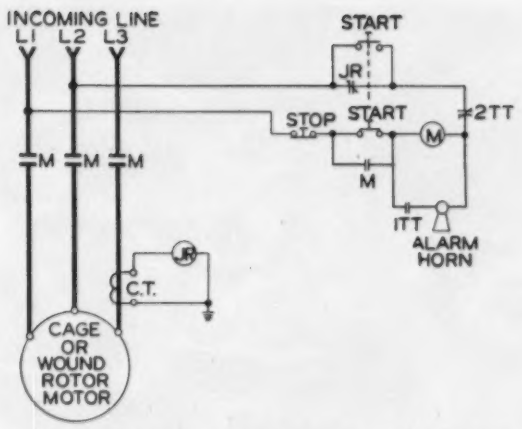


FIG. 5. Circuit containing complete motor overload protection. Switch ITT operates to sound alarm. Switch 2TT operates at danger temperature to shut down motor. Motor is also shut down on stall by jam relay JR. The start button must be held down to bypass JR contact until the motor is up to speed.

a circuit explaining the arrangement of switches for overload protection.

If crushers are stopped when full of crushing material, they must be unloaded before they can be restarted, which is a time-consuming job usually involving hand labor. Because of the thousands of dollars that could be lost in production due to such a delay, removal of all overload protection for some crusher motors could be justified. If gyratory crushers stall when full of crushing material, every attempt is made to start the crusher again with the motor to minimize the amount of manual cleaning and to save time. Although the equipment is not intended for such use, motors are jogged, reversed and restarted repeatedly in an attempt to break away. These motors are often overheated until the insulation smokes but such an abuse seems justified. Overheating of the motor may shorten its expected life to only a few years or even months, but the cost of a replacement motor is negligible compared to the cost of lost production if complete digging out of the stalled crushers were attempted.

Stalled Crushers Can Increase Rotor Current by as Much as 600%

A stall or jam that occurs while the crusher is running is often caused by packing, overloading, tramp iron, etc. in the crusher, or voltage fluctuations. When a stall occurs the motor draws locked rotor current which is usually about 600% of full-load current. The motor can withstand this condition for several seconds before severe damage occurs. It should be disconnected from the line as soon as possible after the stall occurs.

Standard thermal overload relays normally operate sufficiently fast to prevent serious damage. However, thermostat switches have considerable lag and would not operate fast enough to save the motor. Regardless of the type of over-temperature protection used, an instantaneous shutdown of the motor on stalle dconditions is desirable. This can be accomplished by use of an instantaneous current relay, as shown in the circuit in Fig. 5. A manually operated shorting switch or timing relay bypasses the relay contacts until the motor is up to speed. Current relay is set to pick up at a current greater than the maximum load peaks. When the motor stalls, high current causes the relay to operate to disconnect the motor from the line.

Troubles Caused by Voltage Fluctuations

Extreme voltage fluctuations and total loss of voltage can cause the motor to shut down or stall under load. Torque output of a motor varies with the square of the applied voltage. Too low a line voltage can result in reducing the motor torque until crusher load exceeds torque output. If a severe fluctuating voltage condition exists, necessary steps should be taken to improve the stability of the distribution system.

Driving motors will be shut down by the motor controller on low voltage conditions as well as complete voltage outages. The motor controller requires about 75 to 85% of rated line voltage for satisfactory operation. If sufficient voltage is not maintained, line switches in the controller will open to shut down the motor. Voltage fluctuations in crusher plants are common due to the load characteristic of the crusher which usually accounts for 20 to 50% of the total plant load. An actual voltage chart taken across the terminals of a crusher motor is shown in Fig. 6.

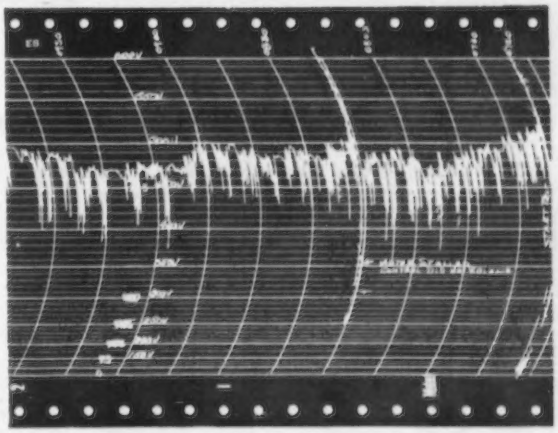


FIG. 6. Voltage fluctuations with several load changes while primary crusher operates at normal loads. Range is 400-500 v.

Voltage dips are almost impossible to eliminate, so steps must be taken to improve the operation of driving equipment. This can be done by operating the motor controller line switches from a dc voltage instead of ac voltage used in standard controllers. The dc operation will permit the controller line switch to hold in to a much lower value than that for the ac operation. Fig. 4 shows a line switch being operated on a rectified dc voltage.

Stalling on complete loss of voltage could often be prevented if the motor is restarted should the voltage be re-

(Continued on p 103)

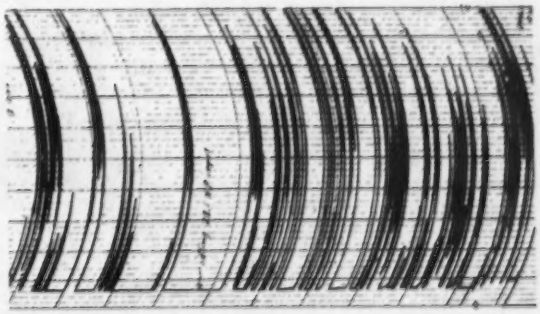


FIG. 7. Kilowatt chart showing power used by gyratory crusher at near full load. Full scale is 400 kw. Motor rating is 150 kw.

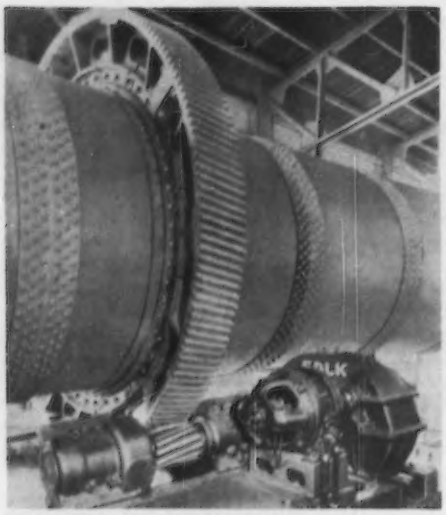


FIG. 1. Modern kiln installation employs helical gears to profit by advantages listed below.

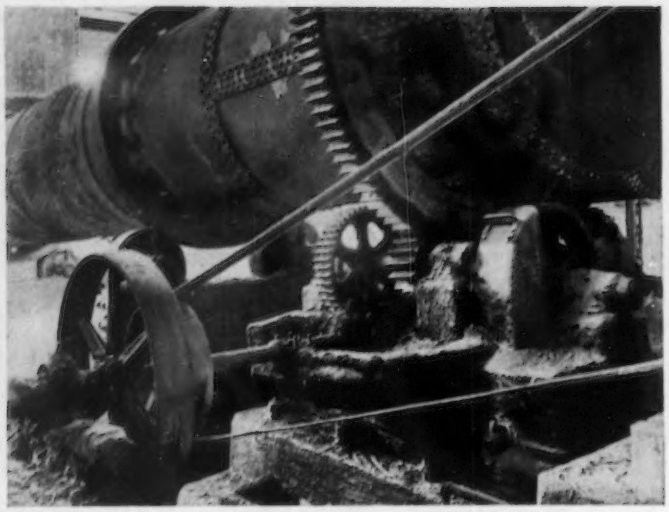


FIG. 2. Early kiln drive used several sets of rough spur gears and belted pulleys. Variations in angular speed could be seen with naked eye.

Why Helical Mill Gears Are Advantageous

1. Increase in physical contact length of approximately 35% for gears of like proportions gives increased surface durability.

2. Lower dynamic loading through improved engagement means increased capacity and lower sound levels.

3. Increased strength because a minimum of two teeth continuously share the load in helicals as contrasted to single tooth loading in spurs.

4. Increase in strength arising from the oblique nature of load distribution on each helical tooth in the zone of action.

5. Higher pressure angle is practical in helical gears than is possible with spurs because the continuity of motion is not dependent on the transverse contact ratio.

6. Higher ratios are practical in helical gear trains; this leads to more economical prime movers, increased efficiency and reduced floor space.

7. Helical tooth contour can be produced with greater facility because deviations inside the theoretical involute do not lead to disturbances in tooth action. Continuity of motion in helicals is determined by the helical trace and is not entirely dependent upon the perfection of the involute profile, as are spurs.

8. Helical gears maintain correct conjugate action. When spur gear profiles wear, they produce profile variations that lead to increased disturbances. Spurs tend to wear out; helicals tend to wear in. Unlike herringbone gears a single helical pinion can be reversed without moving the gear.

9. Helical gears are a little less sensitive to poor alignment since their self-corrective property (with ductile materials) permits the teeth to wear in to the imposed constriction.

10. Lubrication is more complete, and entrapped abrasive or foreign material in the lubricant is disposed of by the skewing engagement of helicals.

These are primary advantages in the use of modern helical gearing for mills and kilns. Experience has demonstrated that there are also secondary benefits, such as increased bearing life, lower shaft stresses, avoidance of bolting failures in the mounting ring flanges, less motor maintenance, better coupling life and similar improvements.

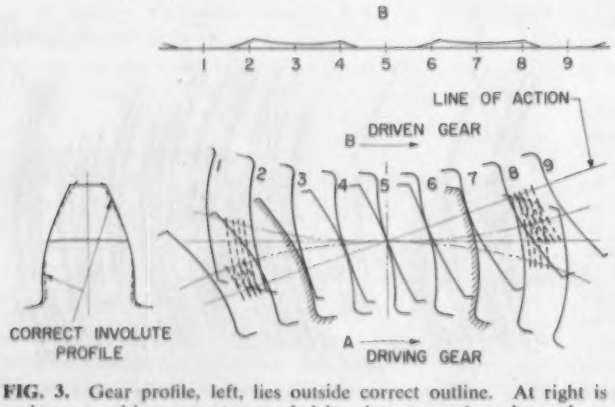


FIG. 3. Gear profile, left, lies outside correct outline. At right is shown resulting premature and delayed contact of mating pair.

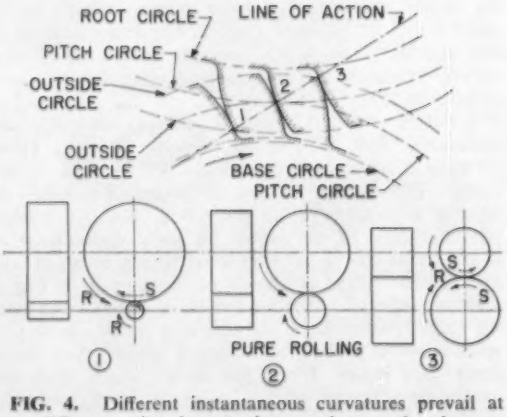


FIG. 4. Different instantaneous curvatures prevail at different points in two spur gears' zone of action.

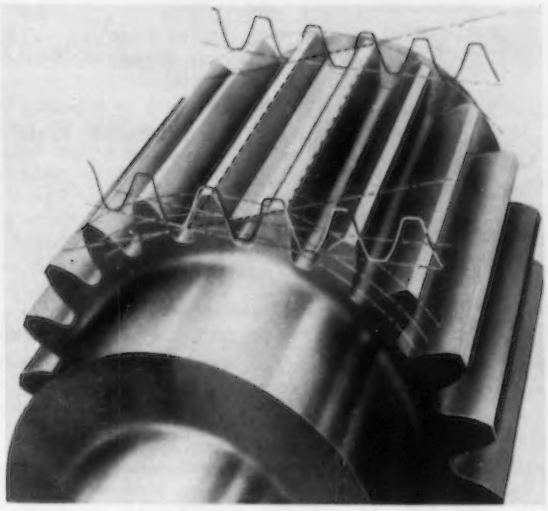


FIG. 5. Spur gear tooth in arc of approach (left) is subject to entire load with maximum stress on tooth surface.

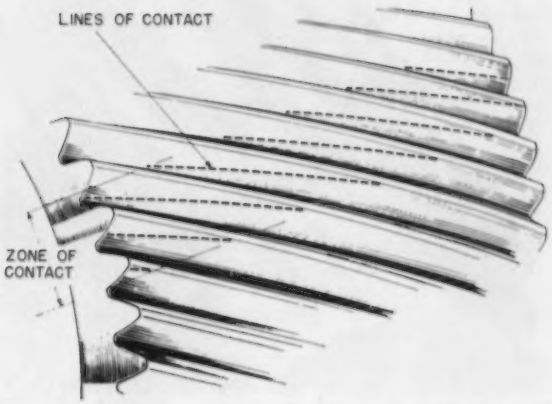


FIG. 6. In helical gearing, a series of teeth share the load continuously if the gears are accurately generated.

Advantages of Helical Gears

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Vice President and Chief Engineer
Falk Corp.

SOME YEARS AGO, a distinct trend toward the single helical gear designs for mills and kilns became apparent. This can be attributed directly to the success of certain pilot installations and indirectly to the difficulties encountered with spur mill and kiln gearing. The herringbone gear had also been employed rather extensively up to that time, though with occasional difficulties. In the interim, as a result of rigorous exploration of the total economic factors, the trend has progressed to the point where the great majority of multiple mill installations are being fitted with modern single helical gear sets. Many kilns, likewise, are being so specified.

Here are the relevant facts involved in this significant development.

Nature of Loading in Mill Gearing

There is an impression that the total load sustained by the gear elements comes solely from the motor and is transformed into useful work at the driven equipment. Such is not the case.

A second source of loading arises from discrepancies in tooth curvatures and variations in tooth spacing. This is termed the dynamic or increment load. Magnitude of supplementary stresses thus imposed on the gear teeth depends on the extent of the gear inaccuracies and on the relative ease with which the mass elastic system accommodates itself to their presence. In a highly rigid system, compensation is largely by strain, i.e., elastic deformations that involve correspondingly high stresses. If the offending gears are contained within a highly elastic system, or one of low effective masses, then a greater part of the correction will be made outside the gear elements themselves; the instantaneous velocities of the gear elements will vary as the demand placed upon them because of inaccuracies of the teeth. In either event, the increment loads will be dependent, in magnitude, upon speed and elastic characteristics, as well as the extent of deviation from ideal tooth forms.

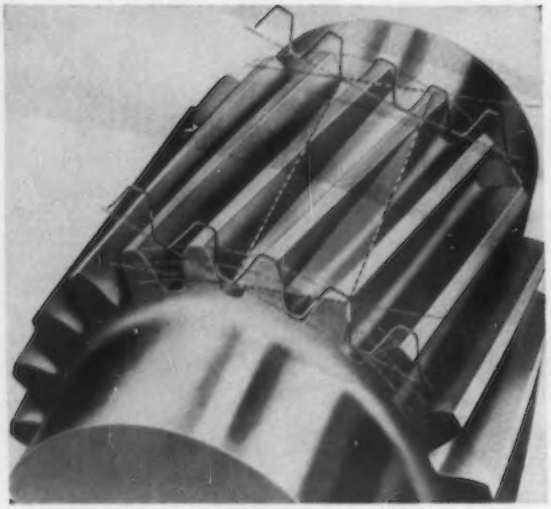
Third source of tooth loading arises from the tumbling loads in the kiln or mill. This action produces energy surges which react upon the revolving masses of the gear system, producing vibratory torques which are reflected in still further supplementary tooth loading. The potential energy of the elevated material in the shell is translated into kinetic energy in the course of falling, and a portion of this variable energy must be absorbed in the gear system as potential energy of strain. This adds still another increment of stress at the tooth surfaces and at the roots of the gear teeth.

Here again, the degree of supplemental gear loading depends on the character of the mass elastic system as well as the magnitude of the reactionary surges. The recommended practices of the American Gear Manufacturers Association include service and application factors which take into consideration the general character of the system as well as the amount of shock to be expected for any particular class of driven equipment. Rod mills, ball mills and pebble mills include a ball or rod charge in addition to the material being processed; thus they require a larger service factor than kiln gears. The main gears of a kiln drive call for an application factor of unity; mill gears are designed with an application factor of one and one-half against the calculated horsepower load.

Resonance

Fourth source of gear loading, encountered occasionally on certain types of installations, is resonance. This occurs only when there is a coincidence of the periodicity of a disturbing force with the natural frequency of the mass elastic system. This phenomenon is more generally associated with reciprocating prime movers or equipment having similar characteristics. However, it has been experienced on kiln drives and, in rare instances, on mill drives. The disturbing stimulus may be the impulse rate of the cascading material. Rough spur mill gearing is also a possible source of resonance if the tooth frequency coincides with the natural frequency.

One solution lies in tuning the sys-



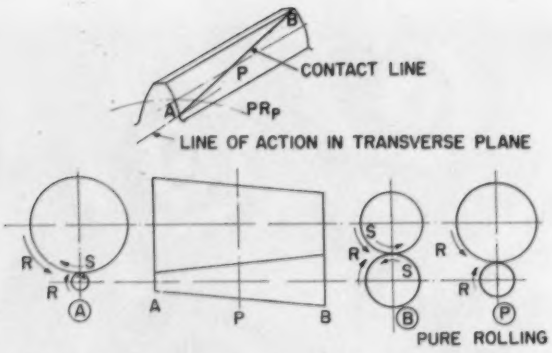


FIG. 8. All phases of contact are simultaneously present and equivalent of truncated cones are in pressure contact.

FIG. 7. In low angle helical gears, total contact length varies only a small amount. Minimum of two teeth share load.

tem so that it cannot be excited critically, another in dampening. Dual drives are employed to avoid the possibility of critical speeds. This places the node of the obnoxious second mode critical in the mass of the kiln where it is relatively inert. The arrangement leads to a considerable reduction in the proportions of the gear elements and may result in over-all economies where the horsepower is in excess of 150.

Early Spur Gear Drives

An early kiln drive comprised of several sets of rough spur gears and belted pulleys is illustrated in Fig. 2. Variations in angular velocity of the rotating kiln were readily detected with the naked eye, the shell moving in impulses coincident with the tooth contact frequency of the main gears. Extensive profile wear, as revealed in the illustration, was responsible for the kinematical distortions which led to increased stresses and loss of efficiency. As a consequence, the operators were faced with frequent shutdowns for repairs, particularly of the higher speed elements.

It was finally decided to replace the initial trains with a modern right angle triple reduction speed reducer which provided much needed relief. It meant imposing an idler between the low speed pinion and the mill gear in order that the housing of the speed reducer clear the shell which is most unusual. It arises from the fact that the ring gear, judged by the AGMA Standard for Rating Spur Gears, is decidedly undersize. With proper proportions, the ring gear should accommodate the reducer. The practice on spur gear mill drives, altogether too frequently, has been to ignore the AGMA recommended practice. The prospective purchaser of geared equipment should be sure that all elements are designed according to the authoritative formulas of the accepted, responsible gear engineering body.

How Spur Gears Act

Disturbances in the transmitted motion may be experienced with new as well as with worn gearing. Fig. 3 illustrates, in the left hand view, a gear tooth whose profile lies outside (proud) of the mathematically correct involute outline. The right hand view shows the mating pair of such teeth in a series of positions of engagement as they progress through the zone of action. At the extremities of engagement, premature and delayed contact are encountered as shown by the dotted profiles. Irregularities in the transmitted motion are the result.

This is plotted diagrammatically in the velocity curve in the upper portion of the illustration. In the arc of approach there is an acceleration at the beginning of contact, then a modest change in velocity as action proceeds through points (3) and (4), followed by a sharp deceleration until, in the region of pitch line contact (5), uniform velocity is reestablished. A similar distortion of motion is experienced in the arc of recess.

Such a disturbance would prevail whether the gear was spur or helical if the tooth outline is proud of the theoretical involute curvature. However, in helical gearing, the tooth can be shaded so that it is inside the theoretical involute a minute amount, leaving the uniformity of motion to be maintained by the helical trace. It is not practical to so modify spur tooth forms because that would lead to a velocity disturbance like that experienced with the proud profile.

In the upper view of Fig. 4, contacting spur teeth are shown at three positions of engagement in the zone of action. Below this are cylinders representative of the instantaneous curvatures that prevail at the initial engagement (1), at the pitch line (2), and at the termination of contact (3). Contact stresses would be expected to reach a maximum at position (1), because of the high curvature of the smaller cylinder (if a single pair of teeth would have to carry the load). If the tooth spacing is accurate—i.e., of a higher order than the elastic deflections of the gears under load—then the critical curvatures will be determined by that point at which one tooth begins to assume the burden of the complete load.

Fig. 5 illustrates, three-dimensionally, the contact zone of a spur gear set at the instant when the load is being released by the departing tooth in the arc of recess (on the right) and when the tooth in the arc of approach (on the left) is being subjected to the total load. The stress on the tooth surface is maximum at that point.

Nature of Helical Gears

In helical gearing, a series of teeth share the load continuously, assuming that the gears are accurately generated. Fig. 6 shows how the loading is distributed. Contact on each tooth extends only partially over the face; the higher the helix angle, the shorter the individual contact, but the greater the number of teeth sustaining some portion of the total pressure. With low helix angles, the individual contacts are greater in length, but the number of teeth simultaneously in engagement is lower. Total contact length for both is about the same.

For low angle helical gears shown three-dimensionally in Fig. 7, total contact length variation is very small. It can also be observed from Fig. 7 that the load is continuously distributed over a *minimum* of two teeth, thus providing a considerably greater strength against tooth breakage than is possible with spurs.

Perhaps the greatest advantage of helical gearing lies in the fact that all phases of contact are simultaneously present. Fig. 8, upper view, reveals that the contact lies obliquely over the tooth surface, embracing every condition from approach contact to recess contact. Sliding is highest at Points A and B, pure rolling prevails at P. Likewise, the contact line simultaneously embraces the regions of high curvature ratio, as well as those of low curvature ratio, where the profile is more rugged.

In helical gears we have the equivalent of truncated cones in pressure contact, as illustrated in the lower view of Fig. 8. High surface stresses that are developed in straight spur teeth at the inception of contact (A) are avoided in helical teeth, because the profile deformations essential to their existence cannot take place while the stronger (lower curvature ratio) portions of the tooth share the load.

Contact Stress and Surface Failure

The broken spur gear tooth of Fig. 9 also manifests severe pitting of the contacting surface. There is a finality about tooth breakage that justifies setting off the "three alarm crisis gong," especially when operations must be halted until a new gear can be manufactured. Progressive pitting and surface mutilation is, however, much more common, and in the aggregate, more costly. Many more mill pinions have been replaced because of wear than because of breakage. The latter is rarely encountered in helical gear operation, because excess tooth strength is obtained with several teeth always sharing the load.

Pitting first develops in the region just below the pitch line, where sliding approaches zero and, possibly, where the lubricating film loses effectiveness. In spur gears this is close to the inception of single tooth contact at which point the contact stress is a maximum. Pitch line pitting is a matter of particular concern in spurs, especially when the entire load will have to be sustained momentarily in that area with whatever loss of bearing the pitted voids produce. The phenomenon becomes cumulative, the decreased contact has less material to carry the imposed load; this leads to higher unit loading with further loss of surface area, and so on, until eventual failure.

FIG. 9. Severe pitting of contact surface is exhibited by broken spur gear.

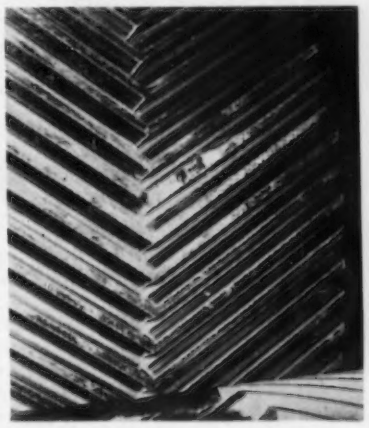


FIG. 10. Herringbone tooth was broken by idler between two such gears. Idler could not accommodate itself to both.

FIG. 11. Axial flutter in herringbone gear mutilated one helix badly.

Helical Gear Pitting

In helical gearing, pitch line pitting is distinguished from progressive pitting and generally is only corrective and incidental. The load is always sustained, as has been explained, by both the more rugged and the more sensitive portions of the profile. Even if the critical region is sharply reduced by pitting, helical gears still function properly because the line of contact does not lie parallel to this region.

Rating in either spur or helicals is a problem of evaluating the total length of the line of contact, the width of the mutual contact, the velocity and vulnerability factors, and equating these to the specific normal load that will maintain the contact stress within the endurance strength of the material.

Double Helical Mill Gears

In the past, herringbone gears have been fitted to mills and, in the main, have given a good account of themselves. The primary consideration in application of herringbones is that the element of lower mass (the pinion) be unrestrained axially so that equal loading of the two helices can be developed at all times.

Every herringbone gear has some axial runout of the apex, one cycle per revolution, regardless of the process by which it has been cut. For gears produced by pinion shaped cutters, there is superimposed another runout determined by the relation of the number of teeth in the cutting tool to the number of teeth in the gear. The pinion must be free to follow this axial movement of the gear apex during rotation. Let us now see what happens when the necessary axial freedom of one of the engaging elements is not provided.

In the continuous tooth herringbone gear of Fig. 10 the broken tooth resulted from interposing an idler between the two drum gears of a conical dual hoist, in which the power of the two motors is supplemented by the energy of the descending hoist load. The idler, as might have been expected, could not simultaneously accommodate itself to the vagaries of the separate runout patterns of the two hoist gears. The result was indeterminately high tooth loadings. Failures began at the apex where high stress concentration exists, and eventually, complete sections of the rim broke out.

(Later several sets of these herringbone gears were replaced with single helical gears. After 5 years, these are highly polished and without any evidence of distress. Other installations have shown similar results.)

This is an example of misapplication. It in no wise impugns the meritorious herringbone gear, which is sometimes the best possible selection. There are gear problems where the choice of gear type is borderline and where dynamic analysis is difficult.

Although herringbone mill drives had been, in the main, acceptable, there were occasional installations where it did not function as intended. Strangely enough, the bad actors were not predictable. Fig. 11 illustrates a herringbone mill pinion in which one helix is badly mutilated, whereas the other is in fairly good condition. Observation and analysis indicated that the difficulty arose from axial flutter during reactionary load impulses. To eliminate pinion replacements, the herringbone mill drive was largely abandoned and new designs involving single helical adopted.

Uranium Milling Forum III

Let's Not Act in Haste on Uranium Milling Policy

E. C. BITZER
Metallurgical Engineer

(Mr. Bitzer, whose first contribution to E&MJ *appeared in the August 1937 issue, is a practicing metallurgical consultant with broad experience including two years as metallurgical advisor in the AEC Division of Raw Materials. With AEC he devoted time to both South Africa and to work on new metallurgical processes for the Colorado Plateau.* The Editors.)

This represents Part III of a discussion of uranium milling policy generated by an interview with Carroll Wilson in the May issue. Part II appeared in June.

MR. WILSON'S INTERVIEW has touched on most phases of a complex problem and whether or not there is agreement on his conclusions and recommendations, an open discussion will benefit the uranium industry.

One of the principal suggestions offered in the interview was the fixing of a price for uranium concentrates that would assuredly eliminate marginal or high cost producers but would bring into play the rules that govern free enterprise. This idea is a logical and appealing method of attack but it should be closely examined. Is the AEC ready for such a step and is industry ready for it? Probably an answer is not available to either part of the question but we can examine the background of each.

Flexibility Needed

The negotiated price arrangement thus far employed gives the AEC sufficient maneuvering room to utilize uranium resources that could not be touched with a fixed market price unless this price were to be set at an inordinately high level. It also enables the AEC (and the contractor) to gamble on processes that *look* good but in which there is a considerable element of risk which can be allowed for in negotiation. So far the AEC has been able to meet the requirements set by national defense policy about which the parties to this discussion—taxpayers and the uranium industry—cannot of necessity be informed. The AEC has been under pressure thus far in this respect. We have no way of knowing how long the pressure will continue but to change a system that works—not smoothly, perhaps, but it works—requires some careful thought.

Fixed Price Now?

Is industry ready for the fixed price? On the record, it is not. As explained in more detail later, the industry has been suffering from labor pains and the period is not passed as yet. One method of alleviating these pains would be to abandon security regulations with respect to processing information as suggested below.

One point not mentioned by Mr. Wilson that is of primary concern to a financial group interested in backing a milling operation is the guarantee of a market beyond the expiration of the current ore purchasing program in 1962. AEC contracts for the purchase of concentrate are for five year periods. A year may be devoted to negotiation and construction of a plant—probably more—so it is obvious that the AEC must answer this question soon. It is a deterrent of considerable proportion.

Another facet of the problem touched on in the interview, but minimized, is that of security regulations with respect to process technology. As Mr. Wilson points out, the need for this is past on account of the considerable amount of information already disseminated. Continuance of these regulations will breed unhealthy secrecy within the industry and hinder the AEC program. Secrecy of any sort generates misinformation - which is easier to disseminate than simple facts which do not have an attractive aura of mystery. The AEC has made some significant contributions to the art of uranium recovery but these can be evaluated and improved upon only by free and open discussion.

Mill Difficulties Overpublicized

One of the factors that has dampened enthusiasm on the part of industry with respect to milling is the bad publicity given to the difficulties experienced by operating plants and uncertainty as to processes. Plateau operation may be roughly divided into three periods or phases. The first was the conversion of existing vanadium plants to uranium recovery. Performance of these plants was and is subject to considerable improvement and doubtless some improvements have been made. These are plants that recover both vanadium and uranium and the combination of processes inhibits optimum performance on the latter.

The second phase was an attempt to get additional production from new plants as rapidly as possible with process innovations based on research completed at the time and not checked out completely by pilot work. The results of too much haste during this period are now being felt and a great deal of the delay in interesting new operators is due to the uncertainties created.

We are now entering a third phase where process information is more substantial and much of it is derived from pilot operation. The plants under construction or on the designer's boards will be better in performance than anything that has preceded. It is to be expected that these plants in turn will be improved upon but the rate of improvement will depend directly on the freedom of industry to investigate and exchange ideas. Security regula-

tions and secrecy do not create a healthy environment for this and should the AEC relax these regulations the industry must also cooperate to the fullest extent.

Lack of information has magnified the risk situation mentioned by Mr. Wilson. Risk is a difficult thing to define because, in addition to the technical problems surrounding it, the factor is strongly affected in this instance by its bargaining features during negotiation. Mr. Wilson infers that uranium processing is in the high risk classification. This is not necessarily a true picture.

Plants Too Costly?

Another debatable statement in the interview relates to the amount of capital investment required per ton-day of capacity ($10-$15,000). This is a discouraging figure with which to confront a prospective investor. Does it refer to plant cost only, or does it include all the expenditure required for an isolated location without power, housing, and access roads? In other words, a maximum condition? Does it include both vanadium and uranium recovery equipment?

It is important that this point be clarified because if plants cannot be built more economically than this the industry might be confined to the construction of large units—in the order of 500 to 1,000 tpd—and few known deposits will justify operations of this size. It is the writer's opinion that under many conditions careful planning and smart operation will make 100-ton operations feasible at a cost attractive to the AEC provided the objective is confined to uranium recovery only. This opinion is based on an engineering study and economic evaluations of several processing problems.

And We Quote . . . .

Several men of the uranium industry have put themselves on record with statements about the milling situation. Here are a few of the more pertinent remarks which have come to our attention.

Dr. Phillip L. Merritt

DR. PHILLIP L. MERRITT
E. J. Longyear Co.
New York, N. Y.

IN AN INFANT INDUSTRY, such as this one, there are always growing pains. Our Government is essentially the only buyer in the markets of the Free World and it has endeavored to purchase as much as is practicable for our defense effort. Under these circumstances, we must all recognize the basic difficulty of the establishment of a long range, stable procurement policy that will fit a great variety of types of ores and production costs.

In the procurement of domestic ores, a fixed schedule for ore of varying grades was adopted and has been remarkably successful. In the case of the procurement of uranium oxide concentrates, both here and abroad, a flexible pricing system has been used —one that is based upon the cost of production, including plant amortization, plus a reasonable profit. Under the procurement conditions which have existed during the all-out effort, this is perhaps the only sensible policy that could have been adopted.

If we are to consider the long-term outlook for the uranium industry, I believe that we soon should begin to think in terms of a fixed, uniform price for uranium oxide concentrates. If our Government—as the only buyer of this much needed commodity—wants to keep the uranium industry in a healthy, expanding state, then the industry should receive the assurances it needs—both in price stability and long-term guarantees.

Some assurances have been given to the miner of ores under the Atomic Energy Commission's Circular 5 (Revised). The refiner, however, is only assured of his prices and his market until the termination of his contract. He must plan his financing, his expenditures for research and for plant improvement on a short payout basis.

I believe that it would be helpful to both the Atomic Energy Commission and industry for the Commission to study seriously the advisability of the establishment of a fixed and uniform pricing schedule. With the shakedown period about over and with the knowledge that the Commission has gained, as to the price range within which industry can produce at a fair profit, the Commission should soon be in a position to give the refiner or the prospective refiner the kind of assurance he needs in planning his operation. *(From an address before the National Western Mining Conference, Denver, Colo., Feb. 5, 1955)*

Lt. Gov. Stephen McNichols

LT. GOV. STEPHEN McNICHOLS
Legal Counsel
Uranium Ore Producers Assn.

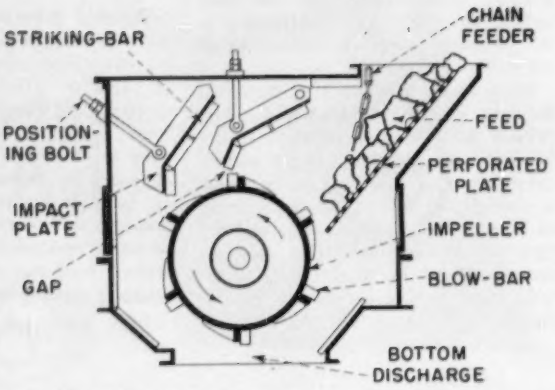
THE GOVERNMENT . . . has an order direction policy that is harmful. It directs producers to send their ores for milling to mills of their choice. There's a variety of price in the existing mills and the private operator in some cases is forced to take less money for his ore because of the directed-ore policy.

In addition, the AEC policy of stout

(Continued on p 100)

Sheldon Wimpfen

WITH Z SHAPED DESIGN two men can change complete set of blow-bars in fifteen minutes on the latest Hazemag models.



EARLY MODEL IMPACTOR has blow-bars held in place by two bolts. Takes two men three hours to change a set of bars.

How the Impact Crusher Can Cut Costs

Editor's note: One big reason the hammer mill can cut operating costs in West Germany is that the mill being used is an impact crusher and not a hammer mill at all! Apparently the misconception or mistranslation is widespread here in the United States. When *E&MJ's* milling practice article in February 1955 on page 128 alluded to German hammer mill practice it prompted a speedy reply from A. J. Kraus, Hazemag Ltd., Münster, Germany. Mr. Kraus points out that the hammer mill and the impact crusher are two different machines and that German hammer mill experience has been similar to that encountered in the U. S. Where applicable, the switch in Germany is to the impact crusher. Mr. Kraus was kind enough to provide us with a copy of Dr. Edgar Puffe's article, published in *Zeitschrift für Erzbergbau und Metallhüttenwesen,* which illustrates where and when an impact crusher can be used to advantage.

Variables Affecting Impact Crushing

1. **Higher the impeller speed the higher the operating costs, the higher the blow-bar wear and the finer the grind.**
2. **More blow-bars on an impeller the higher the crushing capacity. Bars wear on leading edges, but can be reversed to use both sides.**
3. **Larger the holes in the perforated feed plate the coarser the grind and the higher the capacity. For clayey material use feed plate without holes and add water to move feed.**
4. **Clearance between blow-bars and striking-bars is most critical. Closing the gap decreases product size. As bars wear the gap increases and the product becomes coarser.**
5. **Feed rate appears to be independent of the degree of grinding. But the higher the feed rate the more hp needed to keep the grind the same.**
6. **Horsepower requirements are relatively low. Average is about 1 hp per ton feed. Larger units need less per ton hp.**
7. **Feed size is limited to crusher opening. Largest unit has 39⅜ x 89-in. opening.**
8. **Product size is determined by the impeller speed, by the gap and by the natural crushability of the material. Brittle materials, such as slags; ores with good cleavage, like siderite; cemented ore as sandstone, shale and limestone make the best feed for impact crushers. Conglomerate, plastic or clayey ores not suited for crusher. Not so good on tough dense rock. Crusher can be used as an upgrading step in some cases.**

DR. EDGAR PUFFE
Managing Director
Mechernich Mining Works, Germany

IMPACT CRUSHERS ARE REPLACING jaw crushers, hammer mills, roll mills, gyratory crushers and even ball mills in those places where the impact crushing principle applies in Germany today. Where feasible, the impact crusher is being used as a primary crusher, secondary crusher and/or a fine grinder. One German lead mining company has installed one impactor as a replacement for one hammer mill, one roll crusher and one ball mill. Operating costs on the new mill are less than the operating costs on any one of the three units it replaced. As with any type of crusher the impact machine works best on certain types of material.

Lead-bearing sandstone at our Mechernich ore dressing plant was thought to be ideal for impact working. Ore consists of lead-bearing sandstone, barren conglomerate and barren quartzite. Three impact crushers of the Hazemag design were tested extensively by us over a two year period. Most of the testing was done on our own ore; but several runs were made

Crusher Comparison Data at Mechernich Mining Works Ore Dressing Plant

Type Crusher	Size	Feed metric tons	Performance metric tons per hour	Horsepower per metric ton	Operating Cost per metric ton in Deutsch Marks
1. Jaw crusher.....	16x10 in. opening	Sandstone	8–10	1.33	0.22
2. Roll crusher.....	30x12 in. rolls	Sandstone	6–9	2.27	0.34
3. Hammer mill....	24x24 in. opening	Sandstone	5–6	3.64	0.90
4. Ball mill.....	10 ft.x7¼ ft.	Sandstone and conglomerate	13–14	15.1	1.59
5. Ball mill.....	10 ft.x9 ft., 2 in.	Sandstone and conglomerate	25–30	14.8	Similar to No. 4
6. Impact crusher..	10x16 in. opening	Sandstone	15–20	1.14	0.17
7. Impact crusher..	14x30 in. opening	Sandstone and conglomerate	60–100	0.81	Similar to No. 6

on lead ore from Maubach, iron ore from Dogger, lead matte and pyrite from Maggen. We emphasize that the impact crusher seemed to be created especially for the kind of material found at Mechernich, and we can assert that the favorable conditions observed at Mechernich by no means apply to all ore dressing problems. Still, for Mechernich the results were conclusive and eliminated the hammer mill, roll crusher, the primary jaw crusher and has cut the feed going to our ball mill. Much of the discharge from the impactor goes around the ball mill direct to flotation.

This impact crusher was designed and built in West Germany several years ago to produce road metal, crush quarry rock and the rubble and brick from war-damaged buildings. It is now being used to crush and/or grind ores such as lead, lead-zinc, iron, copper, chromite and columbium-bearing sandstone. In addition German industry is treating blast furnace slags, lead matte, copper matte, coal, stone, quarry rock, limestone, bricks, rubble, cement, gypsum, clays, glass waste, rock salt, potash, lime and chemicals with the impactor.

We started testing the impact crusher with the idea of replacing our costly hammer mill in our flotation plant. In addition to the crushers it has replaced, by its efficiency and low operating cost, the impact crusher has replaced the picking belt. We are able to discard 29% of the feed to the impactor and recover 95% of the lead. Crushing so that we can discard the plus ¼-in. discharge throws away much of the relatively barren conglomerate and quartzite.

Heavy-media separation was tried as a substitute for picking, but the impactor and ¼-in. screen were better. We tried jigging as a replacement for picking, but the impactor was superior.

Success of the impactor's crushing and upgrading can be traced to the make-up of the ore. Conglomerate and quartzite do not crush easily. Crushing as we do to in the impactor keeps most of the hard conglomerate and quartzite in the oversize and keeps almost all the lead in the undersize with the sandstone.

Impact Crusher Compared with Jaw and Cone Crushers

	Jaw Crusher	Jaw Crusher	Cone Crusher	AP 4 Impactor	AP 5 Impactor
Feed opening.....	26x16 in.	48x24 in.	58 in.	45x24 in.	65x40 in.
Capacity in cubic meter, hour	15	70	50	75	180
Horsepower input.....	25	75	60	65	150
Gross weight, tons.....	10	26	28	9	23.5
Initial cost in Deutsch Marks	17,500	35,000	50,000	25,200	65,500
Horsepower per cubic meter..	1.85	1.25	1.33	1.08	1.00

All screening to discard oversize is done separate from the mill since the impact crusher does not have a screen to govern size of discharge.

Tough, hard, clayey or plastic materials do not lend themselves to impact crushing. Materials that are friable, fractured, brittle, cemented or have good cleavage are best suited for impact working. The fundamental of impact crushing is the relation, $b = \frac{m}{2} v^2$, where b is the disintegration factor increasing in proportion to the mass and velocity squared. Material having low specific gravity does not crush easily. (See table of variables.)

Test Data

Many tests were run to compare the *AP 1* Hazemag impact crusher with the hammer mill. Both mills treated 6 x 8-in. sandstone ore and crushed to 84% minus 25 mesh. Impactor operated at 20 tons per hour with an average blow-bar and striking-bar metal loss of 58 grams per ton of feed. Average operating cost was DM 0.17 (Deutsch Marks) per ton feed. One set of blow-bars lasted 366.3 tons. Operating costs included new bars, new bolts, perforated plate, bearings, oil, labor, electricity and other repairs.

Hammer mill on the other hand operated at 5 tons per hour with an average mill metal loss of 350 grams per ton feed. Metal loss included hammers and sieves. Average operating costs were DM 0.90 per ton feed.

Lower metal losses per ton have been reported by other mines on larger models. One pyrite mine reported 110 gram average metal loss per ton at 19 tons per hour. Iron ore milling company reported 3.7 grams per ton as average metal loss per ton at 40 tons per hour feed rate.

Our lead-bearing sandstone required 10 hp at the 20 ton per hour feed. The lead company mentioned in the beginning of the article used 20 hp to crush 6 x 10-in. sandstone all through 1-in. at 17.5 tons per hour. This was the company that put in one impact crusher in place of the hammer mill, roll mill and the ball mill.

Impact crushers have the advantage of light weight construction, low degree of vibration, high output, low initial cost, low operating cost and a more uniform product over hammer mills, jaw crushers, roll crushers and gyratory crushers on our sandstone ore. (See table of comparison.)

Product from an impact crusher tends to be more nearly cubical in shape than discharge from the other crushers compared. Brick makers take advantage of this cube forming feature. Roll and jaw crushers tend to make many slivers called "fishes," when treating slate-bearing fire-clay. Impactors break down the slate without the fishes that produce the holes in brick.

We have three impact crushers at Mechernich and plan to install the *AP 5* model. *AP 5* will take a 35 cu ft rock. All belt picking, jigging, hand sledging on the grizzly and other crushing equipment, except the ball mill, have been eliminated. Wear and metal loss have remained economical. Cost of operating over the two year period has averaged DM 0.30 (U.S. $0.07) per ton feed.

The conglomerate and quartzite oversize make good railroad ballast. In concrete aggregate the oversize has

a very good compression test factor. Both conditions are probably due to the impactor breaking down the weak and fractured material very well.

Crusher Design

Material to be ground is fed by chain feeder to the perforated plate in the mill. Plate is perforated with holes same size as the desired product discharge. Undersize falls through the plate and passes out of the mill without much grinding or crushing. Larger the holes in the plate the coarser the grind and the higher the mill capacity. Wet or sticky material can be fed by using a solid feed plate in place of the perforated one and by adding water to keep the feed moving. Plates are made of the same type steel as blow-bars and striking-bars.

Feed from the perforated plate falls on the rotating impeller. Impeller speed provides maximum impact of the ore particle with the impact plates. Material with low specific gravity needs high impeller speed. Two to six blow-bars on each impeller throw the incoming feed against the impact plates. On some models the blow-bars are held by two bolts; it takes two men three hours to change a set of bars.

On newer models with the new *Z* shaped design two men can change all the bars in 15 minutes. (See photo) Bars are reversed when worn down on one side to permit use of the other side. Reversing the bars allows bar use until 50% of the metal has been lost. Blow-bars were first made of 12-14% manganese steel. 12-14% Mn and 1.5% Cr proved more satisfactory. Forged bars were useless. Hard-facing an expensive waste of time.

Striking-bars are attached by bolt to the impact plates to provide a wearing surface. Striking-bars are same Mn-Cr steel. Impact plates, with striking-bars, are held in place at only one spot. This leaves the impact plate free to move and allows tramp iron and mine timber to pass through the mill without jamming the impeller. Gap between striking-bars and blow-bars is critical and can be controlled outside the mill by positioning bolts. As the blow-bars and striking-bars wear, the gap must be closed to keep the crusher discharge from increasing in size.

Ends of the mill where the impeller leaves the housing are clad with Mn-steel. Mill has no discharge screen to wear out. Screening to discard oversize is done separate from the mill. Impeller must be well balanced to prevent vibration. Proper balance permits light weight design. Proper balance and light weight design make it possible to put the impact crusher up on girders or on wheels; another advantage over compression crushers.

Uranium Milling Forum

(*Continued from p 97*)

control of those who can mill uranium ore is inviting a monopoly such as existed in the vanadium business.

It is fast getting to the point where those private mills are all in the hands of the big boys and the independents are being shut out.

A free competitive system for application for licenses to operate mills should be effected at once. Sure, the Government must be certain of some control because of the vital nature of the production, but there should be an opening for the independent to set up a mill if he can do it. (*As quoted in the* Rocky Mountain News, *Denver, Colo., May 8, 1955*)

SHELDON WIMPFEN, Manager
Grand Junction Operations
U. S. Atomic Energy Comm.

OBVIOUSLY one doesn't just go out and build a mill. There is a certain sequence of events which must take place before mill construction can begin.

(1) Determination of adequate ore reserves. In a new area where the potential tonnage is large or not yet determined, it would not be prudent to set the target at a 100- or 200-ton mill before establishing the indicated and inferred reserves and production rates to assure successful operation . . . It is necessary to wait until the potential can be evaluated so that a mill of the size bearing a reasonable relationship to the reserves can be constructed.

In an older area that is served by existing milling facilities and where potential is limited, discovery of a new ore source of sufficent dimension . . . might warrant prompt steps to expansion or new construction.

(2) Dependable mining rates should be demonstrated. Adequate ore reserves may exist as determined by development drilling. But if aggresive efforts are undertaken to mine the material, it would be unwise to construct a mill of the size consistent with the tonnage of ore reserves . . .

(3) An economic and efficient process for treating the particular type of ore must be developed and demonstrated to a degree adequate to insure return of the substantial capital investment required for construction of a mill.

(4) There must be some storage supply of ore to assure the mill operator that there is enough ore available above ground to carry through any periods resulting from a possible curtailment of mine production. Such stockpiles . . . look particularly good to those mill operators who rely heavily on custom ores.

(5) Resolution of the foregoing factors places private capital in a position to weigh the relative economic advantages of uranium milling as compared with other fields in which they might invest. . . . This brings them to the stage of negotiating a contract for the sale of their concentrates to the Commission.

There were times when stockpiles were dangerously small and mill operators cast jaundiced eyes on the future. In 1952 this picture began to change with the initial operations of a number of sizable producers.

Ore reserve information was accumulated so that conclusions might be drawn and plans made. Action was initiated as promptly as possible, with the result that the ratio of ore fed to process to total mine production has been maintained on an even keel since the summer of 1952. To put it another way, even though the amount of ore in stockpile has increased, there has been a nearly proportionate increase in the total capacity of our milling facilities throughout this period.

Mill facilities in operation today are processing ore at a rate more than *three* times greater than the 1952 rate of processing. This will climb to a rate about *five* times greater than the 1952 rate when we include mill construction . . . and expanded facilities which are expected to be completed by the end of this calendar year or early in 1956. Actually, comparison . . . reveals a *465%* increase in processing facilities in just a little over two years.

Other milling contracts in negotiation stages and several under discussion should, by 1957, provide a milling capacity of about *seven* times the capacity of 1952.

One of the real tests of whether or not private industry is interested in getting into the uranium milling business is how many signed contracts for new milling facilities have been executed in the last two years. As a matter of record there have been *twelve* such agreements made. . . .

Of course, the real significance is . . . in the additional milling capacity.

(*From an address before the Uranium Ore Producers Association, Grand Junction, Colo., May 7, 1955.*)

PERSONALS

Harry C. Chellson (left), who has served for the past 8 years as Pittsburgh district manager for *Engineering & Mining Journal* and *Coal Age*, has been named New York district manager for the two publications, succeeding **T. E. Alcorn** who is retiring September 1. **William H. H. Ginder** (right), market research manager and sales promotion manager for *E&MJ* and *Coal Age* for the past 8 years at New York headquarters, has been named to succeed Mr. Chellson at Pittsburgh.

R. M. Sensintaffar, district power manager, Bureau of Reclamation, has been named president of the Wyoming Engineering Society. Other officers are **Kirby Olds,** Cheyenne, vice president, and **Robert O'Connell,** Cheyenne, secretary.

Mitchell H. Kline has been elected vice president, Arrowhead Uranium Co., a subsidiary of Rare Metals Corporation of America in which he also is a vice president.

Durwood J. Hedgecock, division staff engineer, has been named chief engineer, Raynolds Metals Co.

M. A. Upham, underground superintendent, Errington mine, Steep Rock Iron Mines, Ltd., Steep Rock Lake, Ont., has resigned to become general superintendent, Quirke Lake mine, Algom Uranium Mines, Ltd.

George Tower, manager, South American mining interests of Mauricio Hochschild & Co., has resigned because of health, but will continue in a consulting capacity. **C. L. Spencer,** formerly with the Hochschild interests in Chile, succeeds Mr. Tower.

Robert L. Meyer, geologist with Consolidated Coppermines Corp., Kimberly, Nev., has been named assistant geologist with Cerro de Pasco Corp. in Peru.

James E. Atkinson, mining engineer and geologist, has returned to San Francisco, Calif. after several months of exploration work in South America.

Richard Seely has been named superintendent of mines at Temple Mountain, Utah, by Consolidated Uranium Co.

Bill E. Christian has been named director of industrial relations, Chino Mines division, Kennecott Copper Corp., Hurley, N. M. With the company since 1945, he was in the division comptroller's office prior to his appointment.

M. A. Kuryla, safety and employee services director, U. S. Smelting Refining and Mining Co., in Utah since 1952, recently resigned to accept the post of assistant manager, Lima division, Cerro de Pasco Corp.

Carlton H. Rose has been appointed director of public relations, National Lead Co. He joined the company in 1924 and previous to his appointment was manager, specification department.

Frank Lanyon, Salt Lake City, Utah, has been named superintendent, U. S. Uranium Corp.

Robert J. Wright has resigned as chief, Geologic Branch, AEC, Grand Junction, Colo. to join the exploration staff of Climax Uranium Co.

Eugene H. Kinelski has joined development and research division of International Nickel Co., Inc. as research metallurgist. Prior to joining the company, he was associated with Inland Steel Co., Pullman-Standard Car Mfg. Co. and Sintering Machinery Corp.

Rafael Miner has moved to San Luis Potosi, Mexico, having bought the Las Cuevas fluorspar mines. He plans to manage and operate the mines himself.

Dr. L. T. Nel, director of the South African Geological Survey for the past six years, has recently retired.

Arthur M. Anderson, foreman, Embarrass mine, Pickands Mather & Co., has been appointed assistant superintendent, Tioga No. 2 mine, near Grand Rapids.

Andrew Fletcher, president, St. Joseph Lead Co., was elected president of the Lead Industries Association at its 27th Annual Meeting. He succeeds **J. B. Haffner,** former president of Bunker Hill & Sullivan Mining & Concentrating Co. **K. C. Brownell,** president of American Smelting & Refining Co.; **J. A. Martino,** president of National Lead Co. and **M. M. Zoller,** vice president of the Eagle-Picher Co., were elected vice presidents. **Robert L. Ziegfeld** was re-named secretary-treasurer.

Maj. Gen. K. D. Nichols (U. S. A. Ret.), whose resignation as general manager, Atomic Energy Commission, became effective April 30, has been awarded the AEC Certificate of Distinguished Service. Gen. Nichols, who will become an engineering consultant in Washington, is succeeded by **Brig. Gen. K. E. Fields.**

Awards for completing 20 years and 30 years of service were presented to 29 employees of Kennecott Copper Corp.'s Chino mines division, Silver City, N. M. Watches, presented as 30-year awards, went to **Juan Barba, Ramon B. Castillo, Ivo D. Cook, Cristobal R. Donez, Jose Holguin, Pascual B. Jiminez, Pedro S. Lucero, Henry J. Meier, Bautista M. Perea, Francisco Perez, Teodoro O. Rios, George A. Talley** and **John D. Wingfield.** Those receiving 20-year pins were **Refugio S. Apodaca, Gregorio Castillo, Denton D. Hooker, Perfecto L. Jaramillo, Carl W. Johnson, Leslie L. Kelly, Albino P. Lopez, Manuel P. Martinez, Roy L. Mayes, Eugene H. Myers, Max P. Norero, Justiniano C. Pena, Jesus C. Perez, Julian M. Rios, Bennie A. Rodriquez** and **Pedro L. Saiz.** Thirty-year awards also were given to the families of **Andres R. Gonzales** and **Fidencio Gonzales,** who died during the past year after becoming eligible for the service awards.

John A. Brown, chief geologist since 1945, has been named head of the newly formed geology department of Minnesota Mining & Manufacturing Co. He joined the company in 1933.

Andrew J. Martin, member of the Denver office, U. S. Bureau of Mines for 16 years, has been transferred to bureau headquarters in Washington, D. C.

Dr. Phillip L. Merritt, former assistant director for exploration, division of raw materials, U. S. Atomic Energy Commission, was elected director of Sodak Uranium & Mining Co., Inc. He is senior geologist, E. J. Longyear & Co. and advisor of the Atomic Development Mutual Fund, Inc.

Ross Dudley Leisk, vice president and general manager, Sunshine Mining Co., Kellogg, Idaho, has been awarded the honorary degree of Doctor of Engineering at Michigan College of Mining and Technology.

Keith Martin, geologist, Chino Mines Div., Kennecott Copper Corp., has joined Bear Creek Mining Co., Tucson, Ariz., as assistant geologist.

Gilbert J. Matthews, formerly with U. S. Smelting Refining & Mining Co., has been named mine shift boss, San Manuel Copper Corp., San Manuel, Ariz.

PERSONALS *(Continued)*

Royal S. Foote, head of the Geophysical Exploration Branch, Raw Materials Division, U. S. Atomic Energy Commission since 1953, has resigned to form Resources Development Corp., uranium and mining consultants and specialists.

Hubertus van Arkel has resigned as plant manager, Moengo Works, Suriname Bauxite Maatschappij (Alcoa) and is now with Hugo Neu Corp., New York, as a consultant.

Donald T. McMillan has resigned as geologist for the Fresnillo Co., Fresnillo, Zacatecas, Mexico, to accept a position as geologist with the American Metals Co., Ltd., Denver, Colo.

Vernon L. Mattson, former director of the research institute, Colorado School of Mines, has been named to the newly created post of manager of mining and ore processing, Kerr-McGee Oil Industries, Inc.

Fraser M. Moffat Jr., formerly director of dyes and chemicals export department, American Cyanamid Co., has been elected a vice president of Mexican Gulf Sulphur Co.

St. Joseph Lead Company has announced the retirement of the following: **Irving Aubuchon** joined the company in 1913, and was engaged in mill work; **William Boyer** joined the company in 1916 and worked in the refinery; **Frank G. Johnson,** maintenance man, joined St. Joe around 1920; **Edward C. Gregory,** driller, was with the company 41 years; **John P. Sharp,** with the company since 1916; **Charles H. King** joined the company in 1915; and **Lester Shores** who joined St. Joe about 1919.

The following officers were elected at the meeting of the Arrowhead Chapter of the Minnesota Society of Professional Engineers: **Michael P. Walle**, president; **John E. Bovee**, 1st vice president; **L. M. Becker,** 2nd vice president; **Leo H. Ebert,** secretary; **C. W. Maxwell,** treasurer, and **L. L. McGladrey,** director.

Dr. Donald H. McLaughlin, president, Homestake Mining So., San Francisco, Calif., made the commencement address at the 81st annual graduation exercises, Colorado School of Mines.

Dean P. Hanson, former manager, Cortez Chamber of Commerce, has been named assistant secretary of the Colorado Mining Association and will be in charge of the new branch office in Grand Junction, Colo.

Robert W. Shearman has been named secretary of the metals branch of the AIME. Before joining the staff, Mr. Shearman was with Opinion Builders, Inc., specializing in technical publicity. He also was with Bethlehem Steel Co. and Union Carbide & Carbon Co.

Roy H. Glover, vice president and general counsel since 1951, Anaconda Copper Mining Co., has been named chairman of the board, succeeding **Cornelius F. Kelley,** retired. Mr. Glover joined Anaconda at Butte, Mont., in 1943 as counsel.

Max Shake, director of recreation and services, Ray Mines Div., Kennecott Copper Corp., has been named vice president of the Associated Safety Engineers of Arizona for 1955-56. He has more than 25 years with the Ray division.

Hon. Gaspard Fauteux, Lieutenant Governor of the Province of Quebec, has been elected a director of United Asbestos Corp., Ltd., succeeding **Maurice Desy,** Q.C., recently named chairman of the new securities commission for the Province of Quebec.

Walter Bannister has been named senior planning engineer, engineering department, Steep Rock Iron Mines, Ltd., Steep Rock Lake, Ont.

Kurt R. Kuehlthau, general operating engineer, The M. A. Hanna Co., has been appointed superintendent of Homer iron mine, succeeding James Ivers, Jr., resigned.

George F. Groff has been named vice president of finance, Crucible Steel Co. of America. **Daniel A. Porco** succeeds him as comptroller.

R. R. Bryan Jr., former mine superintendent, Orinoco Mining Co., in Venezuela, has formed an association of Latin American mining and construction consultants.

Joseph E. Gordon, mine foreman, has been promoted to assistant mine superintendent, Bunker Hill & Sullivan Co.

Orval Racine, track boss, King mine, Oliver Iron Mining Div., was awarded a special Joseph A. Holmes Certificate of Honor by William Fene, USBM.

Henry S. Wingate, president, International Nickel Co. of Canada, Ltd., has been appointed a director of the Bank of Montreal.

George D. Winans, former mining engineer and shift boss, Banner Mining Co., Tucson, Arizona, has opened a private practice in mining engineering in Tucson.

W. H. Watters is presently conducting some drilling at Round Mountain, Nev., for the Fresnillo Co. of Mexico.

Merle H. Guise, who had been visiting various mining areas in Australia, is leaving shortly for a tour through Indonesia, and the tin dredging areas in Malaya.

R. J. Hawkanson, chief engineer of iron mines, Mesabi Range, Pickands Mather & Co., has been transfered to Ottawa, to represent Canadian exploration for Pickands Mather.

Kerr-Addison Gold Mines, Ltd., has elected **W. S. Row** vice president and director of the company. Also appointed was **J. L. Ramsell** as manager, and **R. J. Beggs** as assistant manager.

Ernest C. Kron, steel metallurgist, Doehler-Jarvis division of National Lead Co., has been promoted to division metallurgist. Mr. Kron, who joined the company in 1947, succeeds **J. C. Fox,** who left in January to open his own consultantship.

Pascal M. Rapier has been named to the post of process engineer, Eagle-Pitcher Co.'s Clark, Nev. plant. Prior to his appointment, Mr. Rapier was affiliated with Great Lakes Carbon Corp.

Blair W. Stewart, vice president, Coronado Copper & Zinc Co., has been named to the California State Mining Board for a term ending Jan. 15, 1959. Re-appointed to the board for the same term was **J. P. Hall.**

M. J. O'Shaughnessy, division industrial engineer since 1954, has been named assistant general manager, Nevada mines division, Kennecott Copper Corp., replacing **Paul Hett,** who resigned due to ill health.

Herbert B. Maw, former Governor of Utah, has been named board chairman of U. S. Uranium Corp.

Julian C. Ashby has been named to the new position of general manager, Utex Exploration Co. He came to Moab in January as chief geophysicist for Utex after 10 years with Atlantic Refining Co.

PERSONALS *(Continued)*

R. W. Nesbitt, Rossland, B. C., has been appointed secretary treasurer of Mining Association of British Columbia, succeeding **C. H. Mitchell,** who has been named executive secretary of Empire Mining & Metallurgical Congress, to be held in Canada in 1957.

Bert L. Wood, who has served as consulting engineer, American Iron & Steel Institute since October 1938, is retiring October 1. He will be succeeded by **William G. Kirkland,** who joined the Institute staff in 1947.

J. D. Dickerson has been appointed to the staff of the central operation department, Crucible Steel Co. of America. He had been chief metallurgist at the company's Midland, Pa., works.

Howard C. Parkman, plant manager, has been named assistant vice president, operations, Vanadium Corp. of America. **C. A. J. Schulte** has succeeded Mr. Parkman.

V. J. Southey, plant manager, Asbestos Corp., Ltd., Quebec, has been named manager, Heath Steele Mines, Ltd., Newcastle, N. B.

Ellis C. Helge, mining engineer, Pickands Mather & Co., has been transferred to West Mesabi district engineering office, Grand Rapids, Minn.

Edward L. Newcomb, formerly with the mineral deposits branch, U. S. Geological Survey, Washington, D. C., has joined the Denver, Colo., staff, division of raw materials, U. S. Atomic Energy Commission.

OBITUARIES

Albert J. Koebel, 75, Idaho metallurgist and inventor of the Koebel fuming process for recovering metals from complex ores, died April 9 at his home following a heart attack.

Barclay G. Anderson, 63, associated with the U. S. Bureau of Mines since 1950, died May 16, while at work. In 1952, Mr. Anderson was loaned to the United Nations and was sent to Yugoslavia as consultant on mining methods.

Jean Model 40, president of Colombian Mining & Smelting Co., Inc., died May 29 in Princeton, N. J. of poliomyelitis. He had been stricken with polio in Bogota, Colombia early in May.

Dr. John A. Allan, 70, former head of the University of Alberta geology department, died in Edmonton, Alberta, late in May. He helped establish the Alberta geological survey.

Francis C. van Deinse, vice president of Yuba Consolidated Gold Fields, and president of Yuba Mfg. Co., died May 31 in San Mateo, Calif. He played an important part in the early development of dredging in Oroville, Calif.

Kurt R. Vogel, 57, secretary, Crucible Steel Co. of America, died June 7 at his home in Pittsburgh following a prolonged illness. He had been secretary for the company since 1940.

Howard R. Huston, 62, retired vice president and director, American Cyanamid Co., died June 8, at his summer home at Truro, Mass. He joined the company in 1930 as assistant to the president.

Gustaf A. Lilliequist, 61, research director, American Steel Foundries, since 1943, died May 31 following a heart attack. He joined the company in 1924.

Charles J. Adami, 78, former Montana and Missouri mining company official, died March 28 in a New York hospital. In 1949 he was awarded a medal at the Colorado School of Mines for distinguished achievement.

Letters *(Continued from p 4)*

Water For the West

Dear Editor:

This is an appeal to the friends of the mining industry in the West to help us secure the passage of the Upper Colorado River Storage Project legislation now before Congress.

With the enactment of this legislation, mining of all types in the Rocky Mountain states will be assured needed water and hydroelectric power for the full development of our vast mineral resources; without this water and power, our mineral development and utilization and all that goes with it—construction projects, mills, smelters, fabricating plants, etc.—will forever be stunted.

We feel that we can ask for support for the Colorado River Storage Project because it puts *our* water to use, creates power at a price at which we can afford to use it, and pays for itself by direct repayment to the U. S. Treasury.

Would your readers let their Congressmen know that they favor the Colorado River Storage Project. If you'd like additional facts, I'll be glad to supply them.

Miles P. Romney, Manager
Utah Mining Association
Kerns Building
Salt Lake City 1, Utah

Symbol Solution

Gentlemen:

On page 106 of the March 1955 issue, your quotation of the mine price of sulphur appears, reading: "Sulphur, Texas, mines, long ton . . . $25.50 @ $27.50."

I notice that the symbol "@" appears throughout the quotations of prices of minerals and I assume that you use the symbol in the same way that the dash is sometimes used, to indicate that sulphur was selling within a price range of $25.50 to $27.50. However, I would like to be sure of this and I will appreciate your advising me of the meaning given to the symbol "@" in these quotations.

Markets Reader
Beaumont, Texas

• *The symbol "@" is the commercial "at" or "to" used generally in reporting on commodity prices. It is so defined in Webster's New International Dictionary.—Ed.*

Protecting Crusher Motors

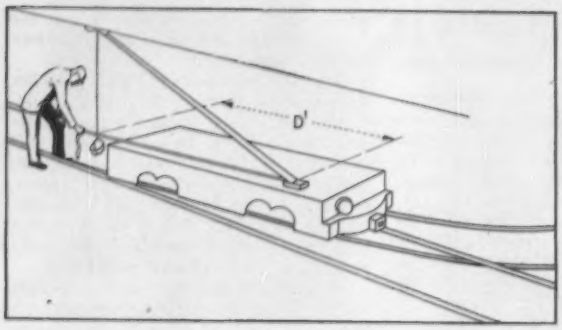
(Continued from p 91)

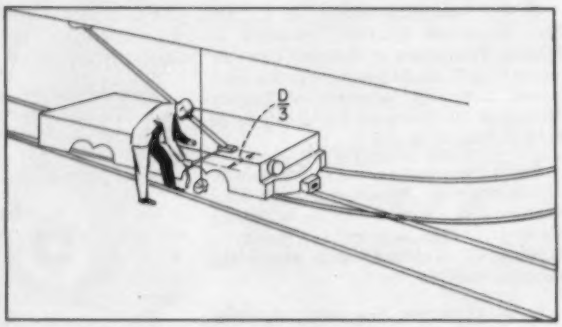
stored before the motor stops rotating. The standard motor controller normally drops out on loss of voltage and must be restarted by the operator. Controllers can be provided with an arrangement that will automatically restart on recovery of voltage if it should occur within a definite time period. Time interval is usually adjustable and should be set so restarting cannot occur after the motor drops to about 50% speed or less. Delay adjustment is usually from one-half to two seconds.

Time delay undervoltage protection to allow automatic restarting after a voltage dip, can be used only when sufficient plant power is available. Current required to bring all the motors back up to speed after a voltage outage of short duration, will be far greater than the current burden placed on the system on normal starting. On normal starting, usual practice is to start each motor individually, but on an automatic undervoltage restart all motors on the system equipped with time relay protection would be started simultaneously. The power system must be capable of supplying this starting load or the entire system will be bogged down. When several large motors are operated on a common power system, sufficient power capacity usually is not available for automatic restarting.

Starting load can be decreased by setting the operating time relays of the undervoltage relays at shorter intervals. Time settings for various motor controllers can be staggered so the least critical load will be dropped first and the most important load last. The time delay restarting feature should be used only where uninterrupted operation must be maintained.

OPERATING IDEAS





Locating Trolley Frogs In Two Easy Steps

STEP ONE: Move locomotive onto new turnout track so shoe is on straight-through wire in general area of new frog location. Tie weight on string and hang from center of shoe. Measure horizontal distance from base of trolley pole to string, as shown above. Take ⅓ of this distance for use in next step. Say it's 6 ft, remember ⅓ of it, which is 2 ft.

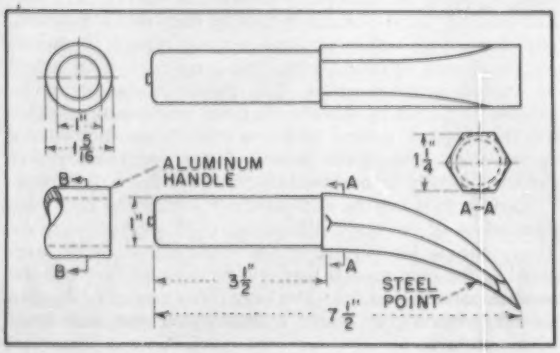
STEP TWO: Inch locomotive back and forth a little on turnout until horizontal distance from pole base to nearest point under straight-through wire is equal to the ⅓ distance in step one. The trolley shoe now rests on the wire where the center of the new frog should be. Use locomotive with length and base height of pole that is average for mine.

FIRST, with straight-through wire hung at proper tension, place frog on wire and mark the ends with file or hacksaw.

"FOR SAVING YOU MANY DOLLARS WORTH OF FROGS AND SHOES over years of trouble-free operation," was the comment of Ohio Brass Co. on the above item in their *Haulageways* magazine. Correct location and correct installation makes the job right the first time. The other three illustrations to the left and below show the correct installation phase. One caution—it might be best to orient all concerned with this work on the safe procedure to follow before the job is started.

SECOND, cut out portion of wire marked off in first step above, and install anchor tips as shown here.

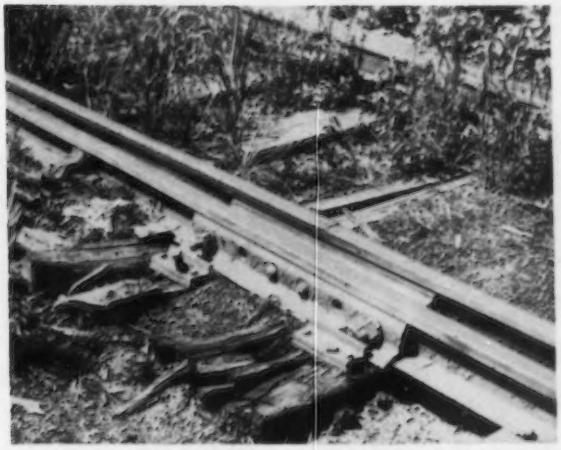
THIRD, bolt anchor tips to clevises as shown here, and frog is hung. Turnout wire may be attached without tensioning.



Light Weight Scaling Bar Cuts Miner Fatigue

A MINER SOON BECOMES ARM WEARY if much scaling is necessary. Lightweight scaling bars alleviate this. Illustrated at left is one used at the Bureau of Mines oil-shale mine near Rifle, Colo. In RI 5074 they are described as having 6- to 10-ft handles of 1 in. standard 61S-T aluminum tubing. The tip, placed on one end only, is made from 1¼-in. hexagonal high-carbon tool steel, shaped into a bent chisel form and not heat treated or tempered after shaping.

OPERATING IDEAS *(Continued)*



COMPLETELY DETERIORATED track structure spells trouble. Drainage, ties and fastenings are all bad at this switch point.

Stop Overlooking Plant Track

ONE OF THE MOST NEGLECTED items of plant maintenance is the railroad siding according to L. B. Foster Co., rail and track accessory supplier. Their photographs are proof. Now that warm weather is here, it is time to spot-check yours.

Drainage is first. While ballast must support ties on sides and ends as well as underneath, it must drain well to prevent early decay of ties and a host of roadbed problems. To get good runoff: break up tightly packed ballast, get rid of mud and weeds that clog surface, and clean out ditches.

Ties are next. They spread load onto ballast and hold rail to line and gage. Split and rotten ones can cause loosened bolts, battered rail ends, crooked rails, etc. Wood should be sound enough to act as beam and to hold spikes firmly. Replace useless ones. Use preservatives and anti-splitting irons as well as good seating and drainage for longer life.

Tie plates need checking. They reduce abrasion on surface of tie and spread load. Best ones are shouldered to hold rail to gage and line but often spikes must do this. If plates are broken, worn, loose or skewed they can cause same damage as poor ties. Get sound plate fastened tight and square on tie with rail held snug and square between shoulders or spikes.

DEBRIS CLUTTERED FROG, badly worn with loose bolts, tells sad story.

BATTERED RAIL-END shows joint needs help. Clean and fix it up, or else.

Joints are danger spots. Fishplates must align ends and make rail act as a continuous, uniform beam, yet allow for temperature expansion-contraction. To have them do that: tighten loose bolts and replace missing ones; replace bent or badly worn fishplates; clean debris and rust away; and apply oil or grease to keep rail and fishplate from "freezing" together.

Turnouts are another check point. All the other checks are especially important here. Debris has a way of collecting at switches and frogs. Get rid of it. Check gage carefully and lubricate operating mechanisms.

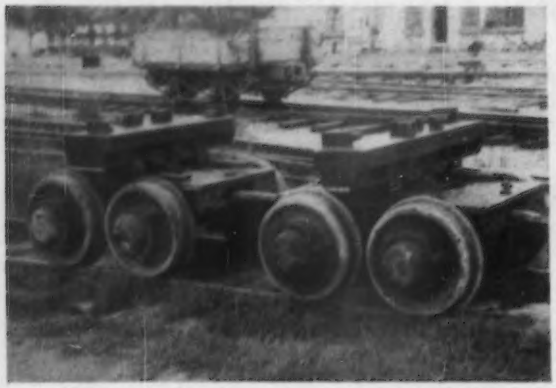
Here are a few other tips. Battered rail ends can be built up by welding and grinding to proper contour and square. Fishplates often can be rebuilt by welding, grinding and straightening with heat. Special anchors must be used to stop creep—spikes loosen too easily.

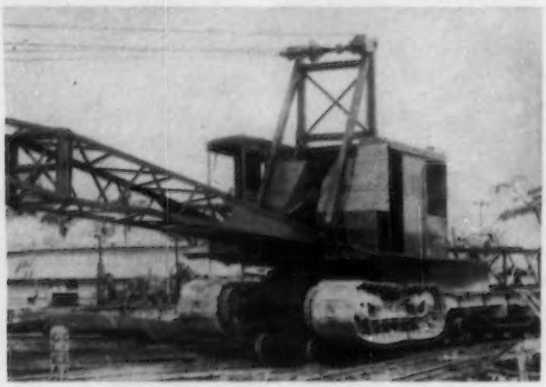
Remember correct gage, good line and smooth surface are the three fundamentals and end results of all design and maintenance. For efficient rail haulage above ground and under, check them.

Use Emergency Measures To End Loose Nut Worry

EMERGENCY NUT-LOCKING methods that have worked when lock washers or other devices were not available are noted by a British engineer, C. T. Bower. In the left photo, one corner of a square nut has been hammered over and when tightened down the burr will dig into the facing and tend to tilt the nut over, thereby increasing the thread friction. In the other photograph, the bolt thread stuck out of the nut and could be split with a hacksaw, then wedged apart slightly with chisel to increase thread diameter and hence friction. Nuts can still be removed with wrench, but, he says, they will not loosen even under considerable vibration. Of course, such measures do not replace regular locking devices for regular use.

OPERATING IDEAS *(Continued)*



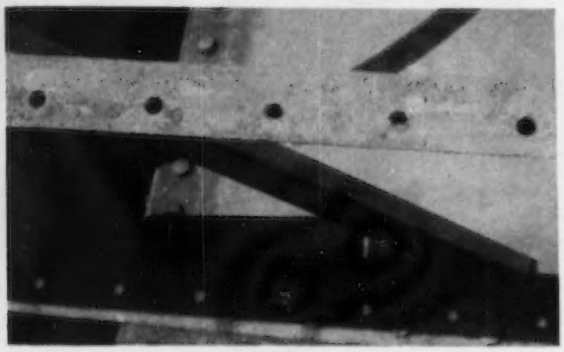


Use Crane's Own Frame and Two Bogies for Rail Move

ALTHOUGH A FLATCAR CARRIED smaller equipment on the 36-in. gage railroad at Demerara Bauxite Co., British Guiana, the 1½- and 2½-yd machines were too heavy. According to Ralph E. Sinke, general superintendent, this used to mean "walking" or dismantling and rail shipment for the 7- to 40-mile moves between pits or shop. But J. G. Johnson and his mechanical department eliminated that time-consuming job by making two sets of railroad trucks suitable for attaching directly to the frame of the machines—one at front, one at rear. Now a locomotive can safely tow the equipment at 5 mph using a special drawbar.

Loading on the bogies is done by walking the machine up a ramp of railroad ties. First, shovel is maneuvered to straddle track with treads outside and parallel to rails. Ties are laid parallel to track in front of each tread to form two ramps. Machine is walked up until bogie can be rolled under. While front of machine is still on ramp another similar ramp is built behind treads. Machine walks backward until frame rests on special bolster of front truck. At same time rear end crawls up rear ramp until bogie can be moved under. Front ramp is dismantled; machine walks ahead down rear ramp until rear bogie carries load of rear end of frame; and loading is done. Whole operation takes only 20 minutes.

Fast unloading is accomplished with ingenious teeter arrangement of several ties. Machine crawls up teeter tie on each side of track until front is clear of truck. Truck is removed and machine goes ahead. Passing over fulcrum tie causes machine to cant forward freeing rear.



Remove Old Plate Efficiently

LOW-VELOCITY DESEAMING BLOWPIPES cut a wide shallow pass quickly with minimum nicking into support members below old steel plate. Linde Air Products Co.'s Oxyweld C-51 was used to remove old plate from barge bottoms by a Texas steel company. Performance figures and photos show method was so good that wider application is warranted. By switching from standard flame-gouging equipment, oxygen consumption was approximately 55% less, and operating time was cut about 60%. In contrast to other flame cutting processes, with the deseaming blowpipes the oxygen pressure can be varied according to depth of penetration desired and thus damage to the support members beneath can be kept to a minimum without slowing down the cutting process.

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Whether or not your present system has been giving you good service, you owe it to yourself to look into this unique and comprehensive analysis of your conveyor belt needs.

Absolutely free—no obligation whatsoever. It is strictly a service of United States Rubber Company. A "U. S." Sales Engineer will contact you in the near future. Or better still, why don't you call any one of the 27 "U. S." District Sales Offices and set up an appointment to see this remarkable new method of analyzing your conveyor belt requirements?

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ODM Urges Government Research Aid

Says U.S. Needs Substitutes for Strategic Metals; More Lead-Zinc Buying Requested

SPECIFIC LEGISLATION to subsidize industrial research for substitute materials has been urged by ODM director Arthur S. Flemming. His testimony came in hearings held by the Senate Banking Committee to determine the need for extending the Defense Production Act until June 30, 1957.

Substitute material research subsidies brought a blast from Senator Morse (D-Ore.) who felt that this would help some large companies come closer to a monopoly status. Research projects, subsidized by the Government, are already in existence. Titanium and manganese are outstanding cases in point.

Flemming would like to see the program set up officially under an amendment to the DPA. He specifically mentioned nickel, copper, cobalt and columbium as materials for which the Government needed substitutes or alternates. In turn, he urged more research to develop titanium, zirconium and silicon metals and alloys. He mentioned some chemical synthetics that could be developed to take the pressure off some basic metal requirements in times of emergency.

Supplies and defense requirements for materials are balanced today, Flemming told the committee, but most defense orders are sufficiently high to warrant priority for such deliveries.

As of June 20, 1955, 147 of the 224 expansion goals set up by DPA have been completed. Others, said Flemming, are nearing completion. The remaining goals, though, will need additional or more potent incentives to get them completed. Flemming emphasized that tax amortization and equipment installation authority in Government and private plants should be sufficient for most remaining materials, although loan guarantees—particularly used by procuring agencies such as Defense Department—will also be needed in some cases.

Senator Douglas (D-Ill.) charged that the Government's bartering of CCC wheat for Mexican fluorspar was unfair to Illinois fluorspar producers. According to the CCC, only one quota for fluorspar was suggested by Dr. Flemming of ODM. And that amount has been committed by Mexico. No further purchases will be made.

Lead and Zinc Purchase Act

Senators Goldwater (R-Ariz.) and Hayden (D-Ariz.) have jointly proposed legislation S. 2046, to purchase lead and zinc in monthly allocations until the Government stockpile has acquired 300,000 tons of zinc and 200,000 tons of lead in this manner.

Lead would be purchased in monthly quantities of not less than 10,000 tons at not less than 16 cents per ton. Zinc would be purchased in monthly quantities of not less than 15,000 tons, at a price of not less than 15½ cents per ton.

In effect, the bill is an extension of the present program of accelerated lead and zinc purchasing, which ends June 30, 1955.

The bill will be handled by the Senate Interior and Insular Affairs Committee. The committee has asked for comments from ODM and GSA. These reports should be in by middle July.

Aluminum Hassle Spotlights "Third Round" Increase

GOVERNMENT WRANGLING over aluminum is continuing in Washington, and as yet, nothing definite toward solving the problem has resulted.

A 100,000-ton diversion of aluminum deliveries to the stockpile was made in June—this took the form of a "deferment" to be paid back, rather than the usual permanent, "no strings attached" diversion. However, non-integrated fabricators complain that nothing short of increased production and supply by primary producers will permanently solve their needs. And primary producers don't want to expand without Government assurances of sales, and Government-sponsored inducements to expand.

Primary expansion programs now nearing completion include Alcoa's 65,000-ton addition and Anaconda's 60,000-ton initial plant (35,000 of which will begin operations in late summer; the rest in early 1956). Reynolds has announced a 25,000-ton plant and Kaiser plans two plants totaling 131,000 tons of additional primary production. Only two plants are still indefinite on construction dates. Olin-Mathieson Chemical Corp. applied for a 60,000-ton plant on its certificate of necessity request to ODM for fast tax write-offs. St. Joseph Lead Company's 66,000-ton plant, also on certificates of necessity to ODM, awaits final go-ahead. If all these projects proceed, there may be no wind left to blow the sails on a proposed ODM "third round" expansion program. If several of the plants delay construction, ODM may be pressured into giving additional aids to the different companies to induce them to build—guaranteed markets and guaranteed loans.

ODM is bitterly divided on its opinion of a "third round." The study of such a program, will tell the tale probably before the end of July.

Netherlands Ratification Advances Tin Agreement

RATIFICATION of the International Tin Agreement in June by The Netherlands brings the quasi-United Nations organization very close to becoming law. The Netherlands is the twelfth country to sign the document.

Until 900 out of 1,000 votes, distributed among producing countries, and 333 out of 1,000 votes, distributed among consuming countries, are counted, the agreement is not effective. So far, 721 votes from producing countries have been received, including Bolivia, Malaya and Nigeria. Both Indonesia and Thailand are expected to ratify before the end of September. Consuming countries have turned in 292 votes to date, including The Netherlands, Australia, Belgium, India, Ecuador, Denmark, Canada and Great Britain. France has a bill before the Chamber of Deputies now. Japan, Lebanon, Italy and Spain have not yet ratified. United States is not a party to the agreement, since the administration does not want the country tied to what it feels is a potential price-fixing body.

As long as the market holds well, and the U.S. stockpiling program continues at its current pace, the effect of such a body may not be felt, when it is ratified. However, tin buyers may notice its effect in slow years, when tin sales are down.

One authoritative Government observer of the tin agreement's progress commented that the ratifications would have to be completed by the end of 1955, or the organization will never be effected for lack of impetus.

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(A true story) It was 4:10 in the afternoon when a purchasing agent called his desk man at Ryerson. "I need some structural channels in a hurry—12 inch, 25 pound . . . let's see, 12 pieces—that's 6000 lbs. Can I have it today? I'm really in a jam."

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Labor This Month

MINE-MILL PREDICTS 10-CENT SETTLEMENT: Officials of the Mine Mill and Smelter Workers Union are saying privately they'll win a "package" agreement with the Big Four copper producers costing 10 cents an hour. This is a far cry from the 30 cent-plus asked in negotiations but it would still be a good deal for the union. Reasons for union optimism:

- The CIO Auto Workers' 20-cent settlement with Ford and General Motors. While Mine-Mill isn't counting on a guaranteed wage, it expects to benefit from the cash terms of the auto agreement.
- Employment and production in the nonferrous industry are high. Mine-Mill expects the companies to pay for an agreement that will keep the mines going. Near month's end the union is talking strike. The settlement will show how good its officials are at prognosticating.

FEDERAL SECURITY FACES PROBE: The tables are being turned on the Government's far-flung security check of defense and Federal workers; the system itself is under investigation. There's no disposition to ease restrictions on suspected subversives, but Congress, Federal officials, union leaders and private citizens are raising their voices against injustices in the program.

One concrete result, to date, is the joint support by Democrats and Republicans in Congress for a high-level commission to review the entire security operation. This bipartisan backing developed in spite of administration opposition—both Justice and Defense Departments back the present systems.

It also means defeat for a Defense-backed measure to extend a security check of all workers in defense-related industries. What the Pentagon wants is authority to keep suspects from any work that would become vital to the country in an event of an emergency—and that includes virtually every industry.

This measure is aimed at a few particular groups—such as suspected left-wing unions. Under the current law, Federal security officers can only go after workers in classified jobs; the rest can't be touched. But these officers claim to know where "hard core" Communists are holding down posts in industry that would become vital in an emergency—and where sabotage could be effective.

The sweeping terms of the bill—to open up just about all industry to security investigation—has doomed its future despite assurances by the Defense Department that it would limit its activities to certain suspects.

While there won't be any new security measure this year, there are still enough laws on the books to handle most pressing loyalty problems. Justice Department has still to use last year's Communist Control Act empowering it to go after Communist-dominated labor unions. Attorney General Brownell promises to move shortly against the suspected labor groups—and up on top of the list is Mine-Mill.

It works this way. Justice will make a case against Mine-Mill—in an attempt to prove left-wing associations—before the Subversive Activities Control Board. If the board rules in favor of the Government, the union will be labeled as Communist-dominated and lose all benefits before the National Labor Relations Board. It could not appear on an election ballot or file unfair labor practice charges.

CIO LOSES TO MINE-MILL: A new challenge by the CIO Steelworkers' Union to wrest bargaining rights from the mine union failed at American Smelting and Refining Co.'s El Paso, Tex. plant. Mine-Mill, in the official NLRB election poll, got 441 votes to 256 for the steel union. This was the second straight defeat for the steel union at El Paso, but it won't end raiding attempts. Rival CIO and AFL groups are determined to take over in nonferrous mining, and this will be stepped up even more.

Mine-Mill is still trying to join in the merger movement to spare itself the troubles and costs of fighting raids. But its officials concede they're still getting the cold shoulder; neither AFL nor CIO are interested. The hope is that if Mine-Mill keeps winning representation votes, the merged federation will open the door for the independent.

SEC Uranium Report Due; Some Changes Expected

SECURITIES EXCHANGE COMMISSION study on uranium stock company practices on issues under $300,000 (the SEC minimum) will probably be made public in early July. The study will undoubtedly point up needed changes in rules to protect investors.

Possible modifications of the present rule, which allows the small issue sales to apply for automatic exemption from SEC authority, could include more requirements on information of the history and financial background of the company involved. Another possible requirement could be a company reserve fund to cover money received from investors until the issue has been successfully completed.

Chances are against lowering of the $300,000 issue minimum to include the small offerings within the full requirements of the SEC for higher issues.

Simultaneously, the National Association of Securities Dealers is conducting its own survey of dealer and broker practices in the uranium mining states of the west—Colorado, Utah, New Mexico, Arizona, and Wyoming. The region was picked out for survey because its NASD membership increased from 72 to 139 within the year ending June 1955. Most of the increased membership is a result of the mushrooming uranium stock sales in that area.

Eisenhower Signs New Reciprocal Trade Bill

ON JUNE 21 President Eisenhower signed the bill extending the Reciprocal Trade Agreements Act for another three years, calling it a "significant milestone" in the foreign economic policy of the U.S.

Clarence B. Randall, chairman of Inland Steel and head of the President's commission on foreign economic policy believes the new law "may give the final push" to establishment of free convertibility of foreign exchange.

Act gives the President authority to cut tariffs in reciprocal agreements up to 5% a year in each of the three years.

Under Senate Amendments to the act, industries which may petition for tariff increases are increased. Previously, a petitioning industry had to prove that injury was industry-wide: now relief may be asked if only a portion of an industry is being affected adversely.

At the signing, Eisenhower also urged U.S. participation in the Organization for Trade Cooperation, organ of General Agreement on Tariffs and Trade.

OTC was created at the international trade conference in Geneva to administer policies of the thirty-four nation group which seeks mutual reduction in tariffs and other barriers to trade.

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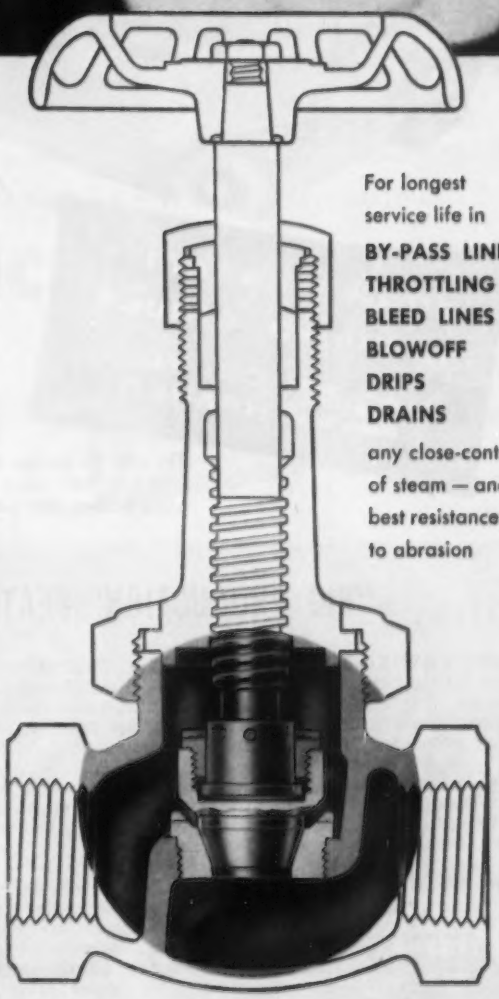

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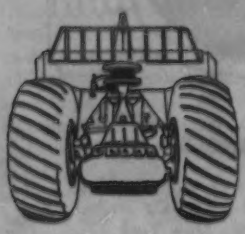

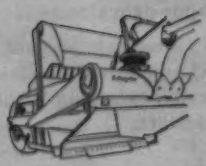

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NEW BOOKS

C. Harry Benedict

Lake Superior Milling Practice, by C. Harry Benedict. Dr. Benedict is the author of *Red Metal,* the developer of ammonia leach for native copper and the 1954 Richards award winner. (See *EM&J,* May 1954) Detailing the technical advances in native copper milling; beginning with mass copper, it follows the development of the stamp, fine grinding, leaching and flotation over the more than 100 year history of the "proving ground" for milling methods. *Red Metal* was good but this is better. Published by Michigan College of Mining and Technology Press, Houghton, Michigan. 137 pp, 13 flowsheets, and 14 illustrations. Price $3.

Freedom From Taxation. By Butler Sheldon, Jr. This astonishing little book proposes an economic philosophy and plan which among other things would: "Discharge the national debt at once. Reduce present taxes drastically. Reduce present corporation taxes drastically. Reduce the work week to 3½ days. Return financial power to the states. Reduce Federal Government expenditures. Cause no inflation or deflation." Whether the author's ideas are sound or not may be difficult to judge, but it can be said that few people will quarrel with the objectives set forth. Another refreshing feature of this book is the straight-forward clarity used by the author to express his ideas. Whether you agree with him or not, you will at least know exactly what he is trying to say. He was motivated to write this book by the conclusion that "the appaling weight of taxation hung as a threat over every business"—a conclusion which he reached in his capacity as head of a private engineering firm which specializes in industrial and economic surveys. Published by Library Publishers, 8 West 40 St., New York 18, N. Y. pp 111. Price $2.75.

Hydro Power Engineering. A textbook for civil engineers by James J. Donald, Professor of Hydraulic Engineering, University of Illinois. Published by The Ronald Press Co., 15 East 26 St., New York 10, N. Y. pp 209. Price $7.50.

English-German Technical and Engineering Dictionary. By Dr. Louis De Vries, Iowa State College. This English-German version was prepared by the author in response to numerous requests from users of his earlier German-English dictionary. Published by McGraw-Hill Book Co., 330 West 42 St., New York 36, N. Y. 997 pp. Price $20.00.

Magnetic Variometers of the Schmidt Type. By J. McG. Bruckshaw. Published by Hilger & Watts, Ltd., 98 St. Pancras Way, Camden Road, London N.W.1, England. Price 22 s. 6 d. Available also at Jarrell Ash Co., 26 Farwell St., Newtonville 60, Mass. pp 115. Price $4.50.

Bergbaumechanik. Fourth Edition. By J. Maercks and G. Jungnitz. A textbook for students and practical handbook for mine operators and producers. Among the useful topics covered by this text are: Rock stress analysis and ground support methods, basic analyses of rock-drill mechanics, and theoretical background for practical solution of hydraulics and ventilation problems. Published in German by Springer-Verlag, Reichpietschufer 20, Berlin W. 35, Germany. pp 669.

Bauxite Resources of Jamaica and Their Development. By V. A. Jans, Senior Geologist, Geological Survey Department, Jamaica, B.W.I. An excellent summary of the geology and development of Jamaica bauxite resources now under way. Jamaica is becoming one of the most important bauxite producers in the world. Published as Jamaica Geological Survey Publication No. 12 by Her Majesty's Stationery Office, London, England. pp 35 plus maps and illustrations.

Metalurgia Extractiva Fisica Mecanica y Quimica, por Emilio Jimeno y F. R. Morral. Dos tomos comprendiendo la metalurgia de metales ferrosos y no ferrosos. Infinidad de ilustraciones, graficos y tablas, incluyendo una descripción breve de los laboratorios activos en España y las investigaciones que se realizan actualmente. De gran valor para los que desenvuelven actividades en países de habla española. Publicado por Publicaciones de la Universidad de Madrid, España. 375. ptas.

Handbook of Drainage and Construction Products, by Armco Steel Corp. drainage engineering staff and edited by W. H. Spindler. Second edition of the handbook which covers the use of corrugated steel in the construction of tunnels, culverts, conduits, binwalls, dams and bridges. Plenty of graphs, photographs, tables and construction hints on the use of Armco products. Armco Drainage & Metal Products, Inc., Middletown, Ohio. 562 pp. Price $5.

Electrification du Fond Des Mines, par C. Bihl. "Dunold," 93, Rue Bonaparte (VI), Paris.

Bulletin 37. Geology and Mineral Deposits of Lake Valley Quadrangle, Grant, Luna, and Sierra Counties, N. M. Written by Henry L. Jicha, Jr. and issued by State Bureau of Mines and Mineral Resources, New Mexico Institute of Mining & Technology, Sororro, N. M. 87 pp with maps.

The following U. S. Geological Survey reports may be obtained from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

Map G. P. 120. Airborne Survey of the Painted Desert Area, Arizona. Price 50c.

Bulletin 1009-A. Uranophane at Silver Cliff Mine, Lusk, Wyoming, pp 12. Price 40c.

Paper 261. Rare-Earth Mineral Deposits of the Mountain Pass District of San Bernardino County, California, by J. C. Olson, D. R. Shawe, L. C. Pray and W. N. Sharp. 72 pp with maps. Price $3.00.

Bulletin 1012-A, B. Fluorspar Deposits in Western Kentucky, by J. S. Williams, Helen Duncan and George C. Hardin Jr. 36 pp with maps. Price $1.00.

Bulletin 1008. Geology and Mineral Deposits of the James River—Roanoke River Manganese District Virginia, by Gilbert H. Espenshade. 150 pp with 11 maps.

Circular 349. Reconnaissance for Uranium-Bearing Carbonaceous Materials in Southern Utah, by Howard D. Zeller. 9 pp.

Circular 347. Water Rights in Areas of Ground-Water Mining, by H. E. Thomas. 16 pp.

Bulletin 1003-A. The "Clinton" sands in Canton, Dover, Massillon and Navarre Quadrangles, Ohio. Oil and gas well drillers' log data and well cuttings organized into a 12 pp pamphlet by J. F. Pepper, Wallace de Witt Jr., and Gail M. Everhart. Price $1.50.

Bulletin 1000-B. Geochemical Prospecting Investigations in the Nyeba Lead-Zinc District Nigeria, by H. E. Hawkes. More results and data on the geochemical method. 50 pp. Price 25c.

Bulletin 1015-C. Geology of the High climb Pegmatite Custer County, South Dakota, by D. M. Sheridan. 95 pp with maps. Price 65c.

Bulletin 996-E. Surface Geology of the Louisville Quadrangle Colorado, by H. E. Malde. 40 pp with maps.

Bulletin 1010. Geologic Controls of Lead-Zinc Deposits in Goodsprings (Yellow Pines) District, Nevada, by C. C. Albritton Jr., A. Richards, A. L. Brokaw and J. A. Reinemund. 109 pp with 30 maps.

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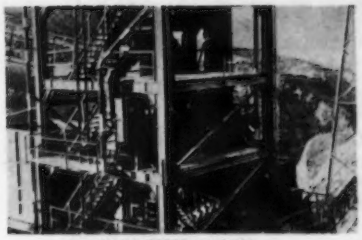

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More Occupational Hearing Loss Data For Your Firm

A RECENT DECISION HANDED DOWN in New York State Court of Appeals has awarded damages covering the impairment of hearing due to continued exposure to noise on-the-job. In the case of Slawinski vs J. H. Williams & Co. 298 N. Y. 546, loss of hearing was held to be an occupational disease. Although the claimant was not disabled and lost no time or wages he was awarded compensation for the loss.

If this decision is allowed to stand it will have far-reaching effects upon the N. Y. workmen's compensation program. Opinion in some quarters holds that this case if allowed to stand will . . . "impose a crippling cost upon the state's industrial economy and the public, and due to a heavy accrued liability on occupational loss of hearing claims for which no reserves have been set aside such change would also threaten the resources of many insurance carriers and self-insured employers with particularly noisy operations," so said Joseph R. Shaw, president, Associated Industries of New York State, Inc.

The following material on occupational hearing is available and it will be to your advantage to get your hands on copies:

1. Occupational Impairment of Hearing, by Theodore C. Waters, general counsel, Industrial Hygiene Foundation of America, Inc., Mellon Institute, 4450 5th Ave., Pittsburgh 13, Pa. This pamphlet is a legal survey of the "Noise in Industry" problem, which has assumed increasing importance in recent years. Legal concepts to date on the health item that's going to hit you, your pocket book and your insurance company some time soon. Covers concepts of disability, statuary references involving loss of hearing, state laws and legislative recommendations of the foundation. 22 pp. Price $1.

2. Occupational Deafness—Real or Imaginary?, pamphlet released by Local 1247 of International Brotherhood of Boilermakers, AFL, Chicago.

3. Industrial Noise, a reprint of the round-up on noise conducted by *Factory Management and Maintenance,* McGraw-Hill Publishing Co., 330 W. 42nd St., New York 36, N. Y. 23 pp. Price 50c.

4. Legal Problems in Industrial Noise, also from *Factory*. 4 pp. Price 35c.

5. Industrial Hygiene Foundation Bulletin 28. Contains Mr. Shaw's speech at the 19th annual meeting. One short section on hearing loss. 241 pp. Address above. Price $5.

Manual for Plastic Welding. Vol. II, Polyethylene. By G. Haim and J. A. Neumann. Published by Industrial Book Co., 1240 Ontario St., Cleveland, Ohio. pp 128. Price $6.

Metal Resources Circular No. 1, Copper, Nickel, Lead, and Zinc Deposits in Ontario. By J. E. Thomson, H. D. Carlson, S. A. Ferguson, E. G. Pye, and W. S. Savage. Published by the Ontario Department of Mines, Toronto, Ontario, Canada. pp 68.

Data Book for Civil Engineers. Vol. III, Field Practice. By Elwyn E. Seelye. Designed to provide the field engineer or inspector with sufficient data to enable him to carry out his job, even when completely isolated. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. pp 394. Price $7.50.

Report of the Commissioner of Mines for 1954, by Phil R. Holdsworth, Commissioner, Juneau, Alaska. 110 pp.

Published by the
Geological Survey of Kenya

The following geologic reports may be obtained from the Government Printer, Nairobi, Kenya, Africa, for the prices stipulated:

Report No. 26. Geology of the Broderick Falls Area. With colored geological map. By A. B. Gibson. pp 45. Price 12/50.

Report No. 27. Geology of the Southern Machokos District. With colored geological map. By B. H. Baker. pp 40. Price 8/.

Report No. 28. Geology of the Kakamega District. With colored geological map. By A. Huddleston. pp 59. Price 15/.

Simplified Site Engineering for Architects and Builders. By Harry S. Parker and John W. MacGuire, both on the faculty of the University of Pennsylvania. Written especially for men in architectural offices who are not familiar with survey methods and problems common to the installation of roadways, buildings, and earthworks involved in construction projects. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. pp 250 including 47 pages of tables. Price $5.

Materials for Construction. By M. O. Whitney, Dean Emeritus, University of Wisconsin College of Engineering, and G. W. Washa, Professor of Mechanics, University of Wisconsin. Latest data concerning sources, manufacture, and fabrication of the principle materials of construction are presented in this up-to-date text. Materials discussed include stone, cement and cement products, clay products, wrought iron and steel, alloys, non-ferrous metals and alloys, wood, and timber connectors. Considerable emphasis is given new testing techniques for various structural materials, Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. pp 752. Price $9.

I. C. 7680. Methods and Cost of Sinking a Shaft Through a Fractured, Water-Bearing Formation at Friedensville, Penna. Written by F. D. Wright in collaboration with Warren Hastings, New Jersey Zinc Co. and Frank J. Kane of F. G. Longyear Co. From the Bureau of Mines, 4800 Forbes St., Pittsburgh, Pa.

Canadian Conference on Pre-Stressed Concrete. A collection of papers presented before some 450 members of a conference held in January 1954. Published by the University Extension, University of Toronto, Simcoe Hall, Toronto 5, Ontario. pp approx 230. Price $2.50.

Canadian Geological Survey Memoir 277. South East Cape Breton Island, Nova Scotia, by L. J. Weeks. 109 pp with maps. Price 75c.

Ontario Dept. of Mines Geological Circular No 2, March 1955. Some Radioactive Mineral Occurrences in the Bancroft Area, by J. Satterly and D. F. Hewitt. 62 pp with maps.

The following volumes of Gmelin Institute Handbooks, published by Verlag Chemie, GmbH., Weinheim/Bergstrasse, Germany, may be obtained through Walter J. Johnson, Inc., 125 East 23 St., New York 10, N. Y., and Stechert-Hafner, Inc., 31 East 10 St., New York 3, N. Y., at the prices stipulated below. The volumes are all published in German.

Selenium. System No. 10, Part A, Section 3. This volume is devoted to the selenium rectifier and selenium photocell, which have been under development since 1930. pp 184 plus 158 graphs. Price $26.64.

Boron. Supplemental Volume. System 13. This is a complete and modern monograph on boron and its compounds, supplementing the 1926 Gmelin volume. In addition to a detailed and thorough coverage of boron and its compounds, the volume presents a complete account of the occurrence of boron and boron compounds geologically and elsewhere in nature. pp 253 plus 28 graphs. Price $33.60 in wrappers; cloth bound $34.80.

Gold. System No. 62, Part 2. This volume follows Part 1 which was published in 1950 (100 pp) dealing with history of gold and its influence on civilization. Part 2 covers occurrence, industrial manufacture, formation and preparation in pure state, colloidal gold, and surface treatment of gold and alloys. pp 306 including 20 graphs. Price $40.32.

Gold. System No. 62, Part 3. This volume completes the series on gold. It covers physical properties; electrochemical, chemical, and physiological behavior; indication and determination of gold; general reactions of gold salts; compounds of gold, and gold alloys. pp 558. Price $74.88.

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Severe applications . . . Hard usage . . . Standard service — Anaconda brings you 3 new engineered cords designed with the exact physical properties needed for each type of job—strength, flexibility and resistance to wear!

Select the cord *best suited* to your needs—based on good engineering and sound economics.

Whichever cord you choose, the Anaconda trademark is your assurance of *premium performance.*

SECURITYFLEX—Underwriters' approved Types SO and SJO.

SECURITYFLEX* CORDS for severest conditions. Toughest, sturdiest cords made . . . used where strength and wear-resistance are a "must." Neoprene jacket *mold-cured in lead* gives top crush, abrasion- and oil-resistance. Cords pay for themselves with long life under severest conditions—in mines, railroads, docks, and in heavy industrial use. Look for the molded-in name, "Securityflex!"

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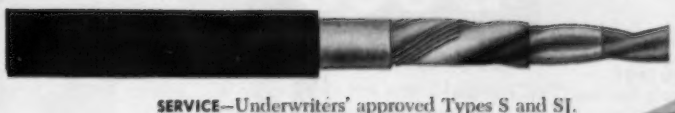
INDUSTRIAL CORDS for heavy industrial conditions and *maximum flexibility.* Lower in cost. Specially designed for use in heavy industry—where cords are in continuous operation and must be tough, flexible, oil-resistant. Tough neoprene jacket. Many industrials stock this one cord for use in virtually all applications . . . reducing inventory problems and costs. Look for the Anaconda marking on jacket.



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SERVICE CORDS for regular duty. Lowest in cost . . . yet have many features found only in higher priced cords of other makes. Special rubber jacket withstands abuse and moisture. Outstanding for appliances, office machines, portable tools—where flexibility and long life are needed.

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THE NEW
D342

THE NEW
D339

190 HP	**INTERMITTENT OUTPUT** Maximum recommended for loads of short duration (1 hour or less) with equal periods at idle or low load.	126 HP
171 HP	**RATED OUTPUT** Maximum recommended for loads of moderate duration (12 hours or less) with equal periods at idle or low load.	112 HP
152 HP	**CONTINUOUS OUTPUT** Maximum recommended for loads of unlimited duration.	100 HP

All at 1200 r.p.m. with full equipment

This is the same trouble-free engine which powers Caterpillar's mighty D8 Tractor. Coming soon: the new D342 Electric Set!

Balancers—standard equipment on the new D339—give this powerful 4-cylinder engine all the smoothness of 6-cylinder performance!

Here are the latest advances in diesel engine design. Compared to other engines in their class, these two new CAT* Engines offer you better operation, less maintenance, higher horsepower and more compact design. Take a quick look!

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For fast starts where a supply of compressed air is readily available, a sturdy vane-type air motor is offered. Also available: air compressors and storage equipment.

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For all-weather starting. This system preconditions the diesel, and supplies full lubrication before diesel is started. Also available: electric starters for the gasoline starting engine.

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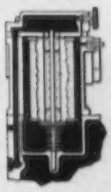

FIELD-TESTED PISTON ASSEMBLIES!

Pistons, rings and rods in these two new engines are like those used in Caterpillar's famous V-type Engines. Heat plugs, chrome-faced rings, cast-iron top ring bands give thousands of hours of operation before inspection is necessary.

MANY OTHER IMPORTANT FEATURES!

BRIEF SPECIFICATIONS

D342		D339
	Four-cycle, valve-in-head	
6	Number of cylinders	4
5¾ in. x 8 in.	Bore and stroke	5¾ in. x 8 in.
1246 cu. in.	Piston displacement	831 cu. in.
1200	Rated speed, r.p.m.	1200
425	Low idle speed, standard, r.p.m.	425

Your Caterpillar Dealer has full details on both of these compact, new engines. Call him today for modern heavy-duty diesels. And remember him, too, for prompt, complete installation and service.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

We'd be glad to send you more information on the new D342 and D339. Just mail the coupon below.

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A MESSAGE TO AMERICAN INDUSTRY • ONE OF A SERIES

TO AMERICAN BUSINESS...

Thanks for Taming a Wild Horse

This is a message of appreciation to American industry. The occasion for the message is the completion of our eighth annual McGraw-Hill Survey of Business' Plans for New Plants and Equipment.

To a considerable degree, our appreciation is personal. It goes to the companies whose cooperation made our survey possible. Twice as many companies as in any previous McGraw-Hill annual survey carefully answered our questions about their plans to invest in new producing facilities. They gave a great deal of expensive time to the job. The cooperation of these companies, which employ nearly eight million workers, put the results of our survey on the firmest footing, in terms of coverage, it has ever had. For this cooperation we are most grateful.

But our appreciation is much more than personal. It extends in even greater degree to the kind of planning of investment in new plants and equipment which our survey revealed. The nature of this planning holds out promise that American industry is on the way toward bringing under control what historically has been one of the most upsetting forces in the American economy—the violent fluctuations in business capital investment. Progress in ironing out these fluctuations gives occasion for public gratitude.

A full report of the results of the eighth annual McGraw-Hill Survey of Business' Plans for New Plants and Equipment will be sent to anyone requesting it from the Department of Economics, McGraw-Hill Publishing Company, Inc., 330 West 42nd Street, New York 36, N. Y.

Very Good Business News

The part of our surveys that attracts the widest interest is the news they give about immediate business prospects. And this year the news is very good. The survey results indicate that American business as a whole plans to invest $29.5 billion in new plants and equipment this year. That is 5% more than was invested last year, and a new high for any year.

Plans for the years 1956-1958 are also remarkably encouraging in terms of the amount of investment in prospect. American business reports that it is already planning to spend within 3% as much for new plants and equipment in 1956 as in 1955. In the past, the expenditures planned for future years have always been sharply lower than those planned for the current year. This is understandable enough. It is sometimes impossible to anticipate all the expenditures that will be necessary a year or more hence. Thus the fact that plans are already made

to spend almost as much in 1956 as this year is very good news about business prospects. The level of investment now planned for the years 1957 and 1958 is also remarkably high—far higher than ever reported for years that far ahead in previous McGraw-Hill surveys.

Taking the Long View

The fact that these plans exist is of immense constructive significance. It clearly indicates that more and more, and now in dramatic degree, American business is taking the long view in making its plans for capital investment. It is developing a program which, if successfully carried out, will go far toward eliminating the habitual, destructive surging and sagging of what is in effect the central power house of our economic system—capital investment by business. Upon the level of this investment depends not only the general state of our prosperity but our progress in raising the American standard of living with new products and new and better industrial processes.

Seven years ago, when we first asked industry to estimate its capital spending beyond the current year, only a small minority of companies could give us any estimates at all. This year, 87% of the cooperating companies—and it was a far larger number of companies—could comply with our request for estimates for the years 1956-1958.

It Pays to Bet on Growth

A number of developments help explain the increase in long-range planning of capital investment. One is the increasing technical complexity of American industry. It often takes longer, in this complicated age, to work out a successful installation of new plants and equipment. Another reason for long-range planning is American business management's increasing conviction that it pays to bet on the demonstrated capacity of the American economy to grow over the long pull. With this goes a corresponding determination not to let short-term business fluctuations upset individual company plans for growth through addition of new plants and equipment. An additional factor, and one of great and increasing importance, is the sense of public responsibility on the part of American business leaders who want to help prevent destructive swings in the levels of new investment.

It cannot be too strongly emphasized that there is still nothing automatic about the carrying out of these long-range plans for business spending. Actual expenditures are still governed in major degree by the general health of our economy. This is fully attested by the fact that the current business recovery has led to a substantial upward revision of the investment plans reported to us last fall when we made a preliminary check of plans for 1955. Either private economic excesses or a reversal of the recent improvements in federal tax policy could gravely upset realization of present plans. Fortunately, neither of these possibilities seems to be an immediate threat.

The very fact, however, that American business management has made these plans and will do its utmost to carry them out is a development of tremendous constructive importance for the American economy. It means that major efforts are being made to tame what historically has been an economic wild horse—the process of capital investment by business. Both for doing it, and for telling us about it in our annual surveys, we extend to American industry our sincere thanks.

This message is one of a series prepared by the McGraw-Hill Department of Economics to help increase public knowledge and understanding of important nationwide developments that are of particular concern to the business and professional community served by our industrial and technical publications.

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"Sell it and make your fortune Mynheer Van Niekirk"

It was the year 1876. Free America was 100 years old and there were great celebrations in Philadelphia. In London, Queen Victoria was proclaimed Empress of India.

In South Africa, children playing by the Orange River found a bright pebble, too pretty to throw away, but when trader Van Niekirk offered to buy it they shouted with laughter and told him to sell it and make his fortune.

But, nobody wanted to buy the pebble so Van Niekirk dropped it in an envelope and mailed it to a government agent who declared it to be a diamond of 21 carats. Then, the governor of the Colony bought it for five hundred pounds and sent it to the Paris Exhibition as a curiosity.

Nobody paid much attention, but this was the first clue to the existence of the diamond fields that would one day pour out fabulous treasures in gems—and in industrial diamonds, those incomparable cutting points which are the vital time-saving, cost-reducing element in Truco Diamond Bits.

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 (Continued from p 73)

Commission Opposes Increase In Minnesota Iron Ore Tax

ALONG WITH ITS RECOMMENDATION that iron ore taxes not be increased the commission appointed to study the iron ore in Minnesota picture makes the following conclusions and recommendations to the state legislature:

Tax basing method using Lake Erie port market values should be continued since value of the ore at lake ports is higher than elsewhere and thereby produces more tax income for the state.

Reserves of high grade Minnesota iron ore were estimated to be sufficient for 30 years normal production. Taconite plants at full capacity will raise the range life by 5-billion tons. Iron ore reserves of the many countries were listed as follows (world total for high grade was set by United Nations at 84,580 tons):

	Ore Reserves To Date (Estimated) Million Tons	
Location	High Grade	Taconite Type
United States		
Minnesota	915	5,000
Alabama	1,000	unproven
California	123	unknown
Michigan	154	unproven
New York, New Jersey and Pennsylvania	1,600	unproven
Texas	none	139
Utah	150	unknown
Wisconsin	6.5	unknown
Wyoming	54	unknown
Canada	550	200
India	21,000	unknown
South America		
Brazil	5,000	10,000
Chile	72	unknown
Peru	100	unproven
Venezuela	560	unproven
Africa		
Liberia	20	unproven
Australia	170	4,500

Commission recommended that the present method of evaluating ore reserves be corrected.

Taconite will become Minnesota's greatest source of iron ore soon. $523-million worth of plants now under construction will have 11-million tons per year capacity. Capacity will reach 40-million tons by 1970. Commission recommended certain basic changes in the taconite tax law.

Cost and competition-wise, Michigan and Minnesota are about equal, but Canada and South American countries produce a lower cost ore. Ore imports to U. S. in 1957 will reach 15-million tons; and may reach 20-million tons by 1960. St. Lawrence Seaway will cut present shipping costs of Labrador ore 16 to 40 cents a ton. Group recommended that cost of foreign (to Minnesota) ore be kept in mind in taxation.

Labor credit should be continued for high grade underground mines, for high-cost operators and for taconite.

Taxation recommendation was that Minnesota taxes on iron ore have been more onerous than on any other class of property. High grade and high tax ore is diminishing rapidly. Higher taxes on iron ore will have the following effect:

1. Aid foreign (outside Minnesota) competition.
2. Hasten the depletion of high grade reserves.
3. Hurt the small and high-cost operator.
4. Discourage taconite development.

Commission suggested that taxes on ore should not be increased. (For a more detailed report of the study see *Report of Legislative Commission on Taxation of Iron Ore* as submitted to to Minnesota legislature 1955.)

Mining Calendar

Rocky Mountain Mineral Law Institute, July 21-23, Univ. of Colo., Boulder.

AIME Rocky Mountain Minerals Conference and fall meeting of MBD, Oct. 5-8, Salt Lake City.

American Mining Congress 1955 Metal Mining and Industrial Minerals Convention, Oct. 10-13, Las Vegas.

University of Minnesota Fourth Annual Drilling Symposium, Oct. 13-15, Minneapolis.

World Symposium on Applied Solar Energy, Nov. 1-5, Phoenix, Ariz.

Nuclear Engineering and Science Congress, Dec. 12-16, Cleveland.

Chilean Copper Law Also Gives Impetus to Mill Construction

BILL WHICH GIVES U. S. COPPER COMPANIES a new rate of taxation (see *E&MJ*, June, p 73) also freed the Paipote Smelter from control by the Mining Credit Bank.

Law creates a new government agency called Smelters Corp. which from now on will run the Paipote Smelter and any other smelter which may be built in the future with government funds.

There has been some preliminary planning of a new smelter in central Chile where there is enough copper concentrates to supply it. Most important mills are located in Santiago, Aconcagua or at the south end of Coquimbo Province: Disputada (700 tpd ore); El Cobre (600 tons); Cerro Negro (400); La Patagua (220); Cerrado (160); Farellon Sánchez (500); Los Maquis (200); and the new Anaconda Africana mill, 12 miles from Santiago which will start with 300 tpd but which may go up to 500 tons as the mine has sufficient ore blocked out to supply it.

There has been talk that the new Smelters Corp. may buy the Chagres copper smelter (built in 1914-1918) at Chagres, half way between Santiago and Valparaiso, while there has also been talk of building an entirely new smelter at San Antonio or Concon, both of which have good harbors.

New smelter will require about $5-million in foreign exchange for machinery. German firms including Krupp have been offering long credits up to 10 years to build the smelter.

Smelters Corp. may also build an electrolytic copper refinery to handle blister from Paipote. Proposed new smelter reportedly could add 33,000 short tons of blister per year. Most likely site for the refinery is between Concepción and Talcahuano, some 260 miles south of Santiago. Central Chile (near Santiago) is very short of power while hydroelectric energy is plentiful around Concepción because of the large power plant at Abanico built by ENDESA, a kind of Chilean TVA.

Canadian Survey

(Continued from p 73)

mountain extends across the Arctic basin.

Scheduled to begin June 10, survey will include ten aircraft, including two helicopters which will be used by the geological parties working from 10,000 aerial photographs of the area to be surveyed.

Survey will follow up operations started last summer when government vessels C. D. Howe and d'Iberville moved 170 tons of food and fuel to Resolute and Eureka on Ellesmere Island. More equipment was dispatched from Ottawa which was taken by airlift to Resolute where advance party of geologists had been waiting.

National Research Gets Titanium Process Loan

NATIONAL RESEARCH CORP. has received a contract for $1,183,495 from General Services Administration to finance construction and operation of a demonstration pilot plant for production

(Continued on p 126)

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Southern Pacific Geologists Train For Huge Mineral Survey of SP Land Holdings

SIGURD K. HERNESS, president of MERCO, believes exploration has three essentials: (1) geologic mapping, (2) magnetic survey and (3) radioactive survey (if called for).

SOUTHERN PACIFIC'S field crew geologist Ralph Anctil operates a gravimeter as part of the survey of the Cave Canyon iron deposit, San Bernadino County.

SOUTHERN PACIFIC LAND CO., subsidiary of the Southern Pacific Railroad, has recently begun long-term systematic mineral evaluation of its extensive land grant (roughly 4.5-million acres in California, Nevada and Utah). Program was initiated by L. Frandsen, land commissioner, and W. C. McCulloch, chief geologist.

Sigurd K. Herness and Charles E. Melbye of Minerals Exploration Research Corp. (MERCO), Golden, Colo., will help organize an efficient exploration department for Southern Pacific.

Lawrence B. Wright, former consulting geologist of San Francisco, is full-time director of the exploration program and Keith Meador is assistant director.

Herness and Melbye recently conducted a six-week training program in the Barstow, Calif., area for the eight Southern Pacific geologists. Stratigraphic section measurement, and detail, semi-detail, and reconnaissance geological mapping were covered, and also the execution of magnetic, self-potential, resistivity, gravity and radiometric surveys.

Geological mapping, together with suitable geophysical methods, was done in each area to evaluate the best combination of methods for a particaular type of geology.

MERCO is headed by Herness, former professor of geology at the Colorado School of Mines. Associated with Herness are Melbye and Gerald E. Gould, both former instructors in geology at Colorado, and Stuart S. Merwin, Fred C. Hohne and Frank Baumgartner, geologists. Their work for Southern Pacific—one of the first projects of its kind on such a scale—indicates a precedent that is being watched carefully by other large land-holding organizations.

Australian Mine Director Sees Taconite Potential

AT A SPEECH GIVEN BEFORE the South Australia branch of the Economic Society of Australia and New Zealand, S. B. Dickinson, Director of Mines, stressed the need for additional production of steel in the state, pointing out that tinplate, household appliances, structural steel, potential exports and defense needs are all on the increase. Capacity of the steel mills at Newcastle and Port Kembla is 2.6-million tons while Australia consumes 3.3-million tons at the present rate.

In his address, Dickinson also stressed the need for a sound iron ore conservation program. Present reserves of high grade ore are 176-million tons, of which 60-million tons are in the Iron Monarch deposit and 120-million tons scattered in the Prince, Iron Duke and Iron Baron and other deposits on the Middleback Range. Iron Monarch ore is high in manganese. Rest are low in Mn. Current iron ore production rate is 3-million tons a year. Production since inception of mining on the Middleback was 54½-million tons with 52-million coming out of Iron Monarch.

Laboratory work indicates that Australian taconite ore can be upgraded if required investment capital can be had. Taconite reserves in Australia were estimated at 4-plus-billion tons.

Titanium (*Continued from p. 124*)

of titanium metal by a new non-Kroll process developed by the company.

Plant, is being designed for 1,000 lb of metal per day.

Process, which has been in operation on a small pilot plant scale in Cambridge for two years under a joint program with Monsanto Chemical Co., produces metal of high purity in crystalline form.

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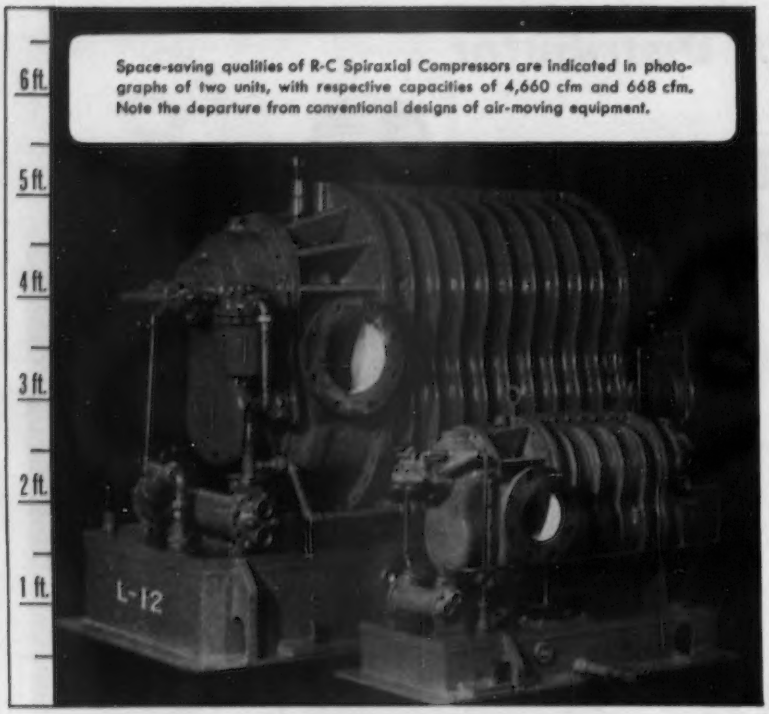

Space-saving qualities of R-C Spiraxial Compressors are indicated in photographs of two units, with respective capacities of 4,660 cfm and 668 cfm. Note the departure from conventional designs of air-moving equipment.

For intermediate pressures . . .

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1. **No internal lubrication —hence oil-free air.**
2. **Internal compression assures peak efficiencies at required pressures.**
3. **Direct connected for speeds of 1750 rpm and 3550 rpm.**
4. **Uncooled — requiring no water-jacketing.**
5. **Small space — low noise level.**

Before deciding on any air-handling equipment, see the new developments in R-C Spiraxial Compressors.

The amazing efficiency and economy of this latest Roots-Connersville development in air-handling equipment have been proved in continuing orders and installations.

Bridging the gap between the R-C *dual-ability* lines of Centrifugals and Rotary Positives, Spiraxials provide a capacity range from 700 cfm to 5,000 cfm, with pressures from 15 psi to 30 psi. Either single-stage, or multi-stage installations for higher volumes, are completely satisfactory.

For new projects, we suggest a study of these newest Spiraxials. Or, it may well be that they will soon pay for themselves as replacements for present less efficient equipment. Ask for performance curves, and details in Bulletin SC-354.

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Centrifugal and Rotary Positive Blowers and Exhausters • Positive Displacement Meters • Vacuum Pumps • Gas Pumps • Inert Gas Generators • Spiraxial Compressors

Danes Will Mine Pb-Zn On Greenland Coastal Strip

NORTHERN MINING CO. LTD., Danish firm with Canadian and Swedish participation, is planning to begin extraction of lead and zinc from a 100-mile wide coastal at Mesters Vig, in Greenland.

Decision to start mining and plant construction (set for early 1956) came after 18,000 ft of test borings were made in the winter-swept land. Metals occur in galena and sphalerite, scattered about a vein of quartz. Over 6,000 ft of tunnel were cut in one mountain. Estimate of total value of the deposit was set at 100-million kronor (US$14.5-million). Six or seven years will be required to extract the ore.

Mills and flotation plant will, according to plans, be installed inside a mountain, both to save building materials and resist extreme temperatures.

IN THE U. S.

ALASKA

Alaska Mining and Exploration Co. of Seattle is reported to have taken over the DMEA exploration work at the Riverside lead-tungsten mine near Hyder. Red Hawk Mines Alaska, Inc., who earlier planned the same move, is apparently no longer in the deal. Pacific Northern Minerals of Spokane originally had the contract.

Since the rehabilitation of the Red Devil mercury mine was undertaken Feb. 1, rapid progress has been made in surface work, and underground exploration work will start shortly. A shaft has been sunk 165 ft from the 2nd to the 3rd level, from which the underground exploration will be conducted. New camp buildings and cottages are being built and 35 men are employed. A total of 200,000 lb of materials and equipment have been flown to the property.

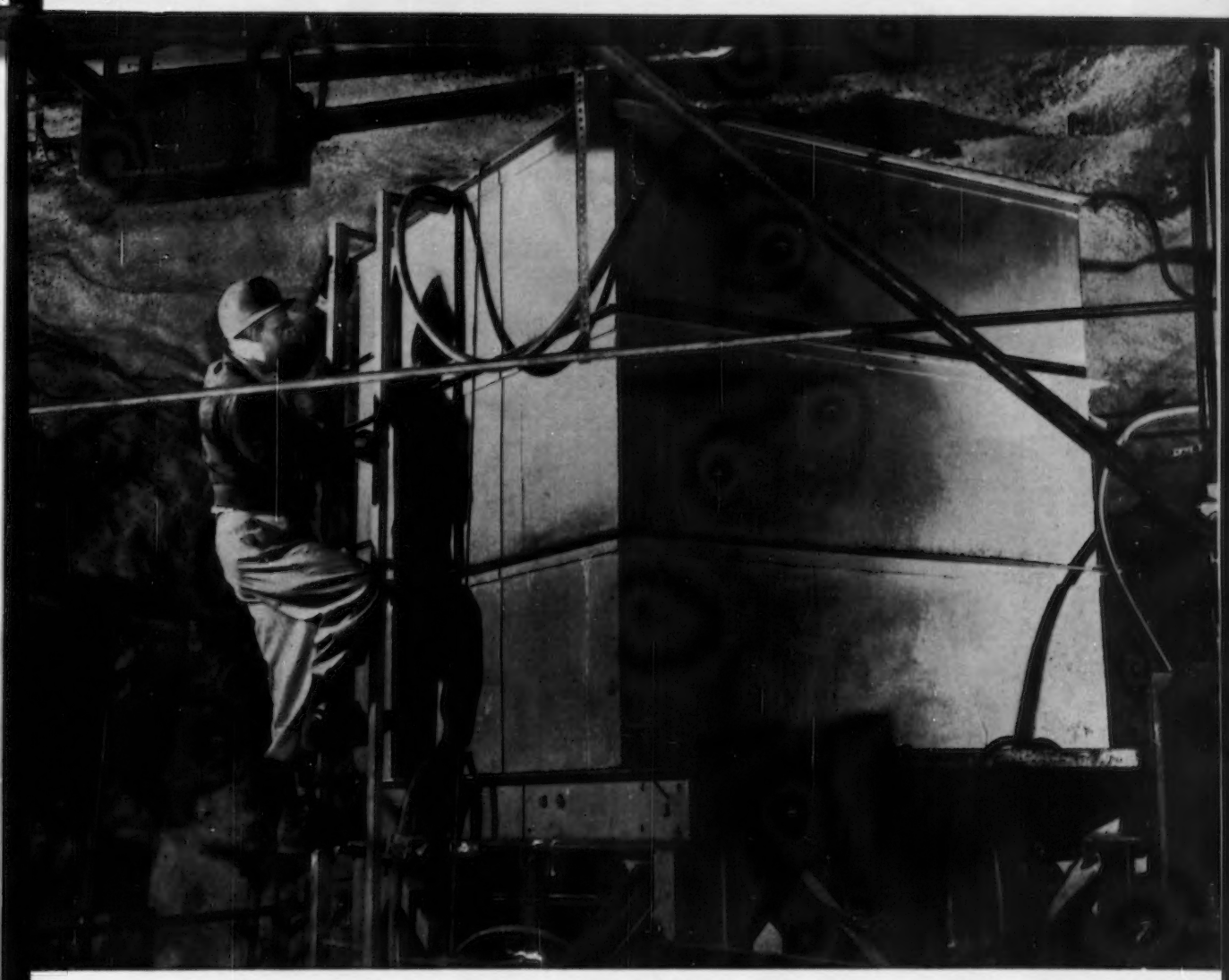
ARIZONA

Diamond drilling of promising uranium ore structures in the Globe-Young area will continue for several months, AEC officials report. AEC hopes tests will reveal structures which would help prospectors in the district, which has a good potential but has not been developed rapidly.

This is the first such uranium diamond drilling done in Arizona, except in the extreme northeast corner.

Rafael Salgado and Frank Sims, miners at San Manuel Copper Co.'s Red Hill mine, have been awarded medals by the Joseph A. Holmes Safety Association for their rescue of a fellow worker during a premature blast last year.

Also honored in Arizona, among 14



Mill Chief J. G. Craig climbs a ladder to inspect one of the Stainless Steel tanks used for storage of copper sulphate solution.

20% Copper Sulphate Solution stored in tanks of Stainless Steel

TO HANDLE a highly corrosive 20% copper sulphate solution, Empire Zinc Division of The New Jersey Zinc Company installed Stainless Steel storage tanks at its Gilman, Colo., operation more than three years ago.

Here again Stainless Steel has demonstrated its superior corrosion resistance. The tanks have required no replacement or maintenance, and officials say they expect them to last at least 10 years.

The copper sulphate solution is stored at a temperature of 120° F. From the Stainless Steel tanks, it is fed to the flotation circuit where the values are separated from each other and from the gangue.

See The United States Steel Hour. It's a full-hour TV program presented every other week by United States Steel. Consult your local newspaper for time and station.

This is only one of hundreds of jobs Stainless Steel is handling in the mining and recovery of metals. As chemical recovery methods become more widely used, Stainless will play an even more important part, for it has proved itself in both the chemical and mining industries.

Whenever you're looking for long, trouble-free life in spots where corrosion and abrasion take their toll, think of Stainless Steel. And for finest performance, be sure service-tested USS Stainless Steel is used.

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UNITED STATES STEEL

"Secret" of *lower* belt costs is concave sides

This brick machine at a western clay products company originally used a flat belt drive to transmit power. Belt slippage held production down and belt replacement was required twice a year. A Gates Vulco Rope drive, installed on this machine four years ago, eliminated the frequent belt replacements and increased production 15%.

Plants that keep track of costs on drives know this: they get longer wear at *lower cost per year of service* when they specify Gates Vulco Ropes—the V-Belts with *concave sides.*

Here's WHY concave sides keep belt costs down:

When the Gates belt is bent around the sheave, the *precisely engineered* concave sides (Fig. 1) fill out and become straight (Fig. 1-A). Thus the belt makes uniform contact with the sides of the pulley.

This full, uniform contact assures *even distribution of wear.* Naturally, *even wear* means *longer wear.* And longer wear cuts belt replacement costs...reduces down time...contributes to profits.

Prove to yourself the value of concave sides

Bend a straight-sided belt (Fig. 2) and feel the sides *bulge out* around the bend. You see immediately that the bulging sides prevent an even fit in the pulley groove (Fig. 2-A). Uneven contact causes faster wear...increases belt replacement costs.

Reduce costs and down time for belt replacements—specify Gates Vulco Rope Drives—the V-Belt with *concave sides* (U.S. Patent 1813698). The Gates Rubber Co., Denver, Colorado—*World's Largest Maker of V-Belts.*

Gates Engineering Offices and Distributor Stocks are located in all industrial centers of the United States and Canada, and in 70 other countries throughout the world.

TPA 46-B

GATES VULCO ROPE DRIVES

Arizona *(Continued)*

awardees in the nation, was Donald Salter, mechanic at Bagdad Copper Corp. He save a fellow worker when an electric shovel switch exploded, wedging the victim in the machine and igniting his clothing.

Black Pearl Mining Co., near Bagdad, has been awarded a $127,285 exploration contract to develop tungsten properties. Total value of Government participation is $95,463. Mine has been under development for four years by J. H. Cazier and Edgar A. Scholz. New exploration program calls for sinking a 150-ft shaft and 400 ft of drifting from the shaft.

Mining activities in Santa Cruz County are accelerating with all available workers in Nogales and Patagonia employed. A small flurry of uranium mining is reported in the Hosey area and in Mansfield Canyon. Diamond drilling is under way at Washington Camp, and Ventures Ltd. of Canada is diamond drilling at the Mowry lead mine. A strike of high-grade lead has been reported at the Edward Mack claim east of Amado.

Arizona manganese will be processed at the Federal purchasing depot at Deming, N. M., which will be stepped up to 24-hour-a-day operation. Since closing of the buying depot at Wenden, shipments clogged the Deming depot. Arizona producers complained they could not get shipments handled. The round-the-clock schedule will permit Deming to handle about 20 carloads a day.

Drill work has been started in Northern Arizona on a suspected vast uranium deposit following purchase by Rare Metals Corp. of America of Arrowhead Uranium properties for a reported $1-million. Land is a mile east of Cameron. Rare Metals is a subsidiary of El Paso Natural Gas Co.

At the same time, the AEC is negotiating with Rare Metals for construction of a uranium mill at Tuba City on the Navajo Indian Reservation.

M. H. Kline, vice-president of Rare Metals, and a former official of the U. S. Bureau of Mines, said the mill will cost approximately $2.5-million.

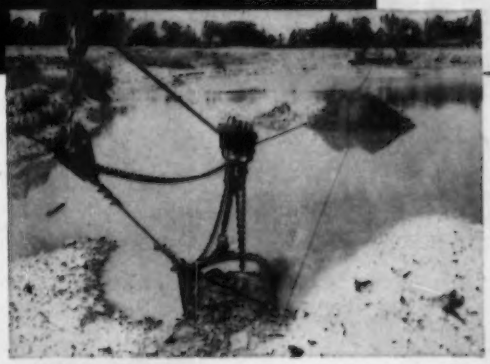
CALIFORNIA

Tungsten deposit 60 miles east of Bakersfield has been discovered by Bob Russell and Ralph Rosenblatt of Hayward. The mine, called the Four R's, is near a producing property, Tungsten King. Russell and Rosenblatt have no immediate plans for developing the property. They discovered it while prospecting for uranium. Samples taken to San Francisco for assay were found to have a high tungsten oxide content, Rosenblatt said. Deposit occurs in quartz.

Alaska Juneau Gold Mining Co. has revealed it is negotiating for uranium property on the Colorado Plateau. Francis Frederick, Berkeley, Calif., consulting geologist, was retained to look over the

the pit: *tough...* 70% ROCK 30% SAND

the machine: Sauerman 2½-cu. yd. slackline cableway excavator



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California *(Continued)*

prospect, according to C. A. Norris, president.

Company, whose gold mines in Alaska and California are idle, is investigating several diversification possibilities, among them a pulp mill at Juneau. Mill would use the power system installed for the mine.

Verdi Development Co. has awarded contract for process engineering, plant design and construction of its uranium mill in Kern County to MacAfee & Co., Los Angeles consulting engineers.

MacAfee & Co., consulting engineers, will design and construct the new 100-tpd tungsten mill for Tyler Ranch tungsten mine, owned by Gold Shares, Inc., in Tulare County. Plant was to be ready for operation by Aug. 1. Ore reportedly averages 0.75% WO_3 in large tonnage.

COLORADO

Despite wide publicity given various "upgrading devices" for low grade uranium ores, only one such operation is now being carried out successfully, says Sheldon P. Wimpfen, manager of the Grand Junction operations office of the AEC.

This, he says, is the sand-slime treatment which Vanadium Corporation of America is using at Monument No. 2 mine in Arizona, where ores between 0.07 and 0.08 uranium oxide are upgraded three times in value.

Wimpfen said that despite studies by the AEC in conjunction with the U. S. Bureau of Mines at Salt Lake Experiment Station on "marginal disintegration," there have been no commercial applications developed to date.

Other studies at Grand Junction and at eastern research centers of the AEC are being carried out on the problem, he said.

There is, of course, hope for a solution. The VCA sand-slime treatment might be used in certain other areas on the Plateau. But generally the upgraders face the following problems:

1. The process must fit into the mining situation and the type of ore.

2. Many publicized custom "upgraders" are a form of sand-slime treatment requiring water. Such beneficiation is of little application at a mine site where there is a lack of water. In most places on the Colorado Plateau, water tends to come at a premium. Few mines of substantial size are near "free" water supplies.

3. Wimpfen says that any number of persons have come to the operations center here with upgrading devices. "What they forget is percentage distribution" in their goal to attain a percentage increase in value, says the AEC manager.

In other words, how much uranium have they lost "down the tail race" in moving 0.05 ore to 0.5 ore.

4. The resultant "upgraded ore" is generally a fine material. Transportation

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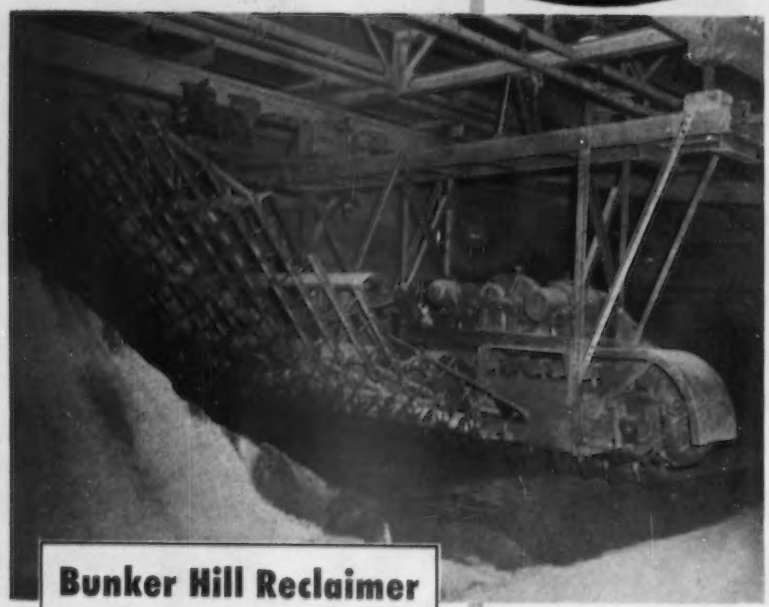

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Achieves complete uniformity of preparation charge and is fully automatic. Operates to full capacity of subsequent flow sheet. Stearns-Roger engineered design saves weight for lower first cost. One machine serves any number of tandem bedded piles, each 30' wide. The unit shown at Bunker Hill & Sullivan's Kellogg custom lead smelter has a rated capacity of 150 t.p.h. on minus ¼" material weighing 110-125 lbs. per cu. ft. with 2-10% moisture. This Reclaimer has operated as high as 200 t.p.h. for sustained periods. Over 15 months' initial operation is reported highly satisfactory.

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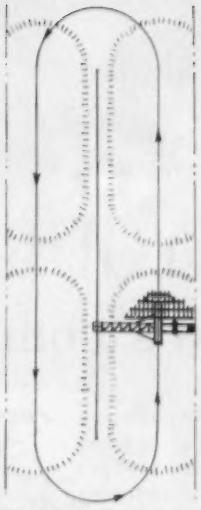
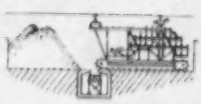


PLAN OF BEDDING PLANT



ELEVATION

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STEARNS-ROGER ENGINEERING COMPANY, LTD., CALGARY

Colorado *(Continued)*

problems may be imposed here. Should it be sacked, hauled in special bin trucks? These are all cost factors which must be weighed against the initial outlay and efficiency of the process.

Two most popular processes under discussion in Plateau uranium circles are air separation and electrostatic separation.

In air separation, the fines—containing most of the uranium—are blown up and out of the mass of coarser material with declining radioactive values.

Through differences in charges between uranium and non-uranium material, the electrostatic separation accomplishes about the same thing.

Cost of grinding is an important factor in either air or electrostatic separation.

Dresser Industries and other major engineering and chemicals companies are hard at work on development of a process which can meet many "general" qualifications of a variety of Plateau properties, it is reported.

A ten year program, for greater efficiency and production, will place Telluride Mines, Inc., on a more profitable basis. A. C. Hilander, superintendent, states that the mine closed down about a year ago because of low metal prices, low grade of ore, high cost of material and inadequate manpower of the right type. Under the new program, the ore will be upgraded, with it being an offense for any miner to punch out walls unless directed to do so. Skilled men will be limited to skillful work, and "super-service" will be provided for them to increase production. Nippers will take care of the men in the stopes.

Underground supply houses and shops will make materials readily available. Instead of having several men pushing tram cars, the scram method, which employs slushers, will be used. Under this system, one man can move four times as much muck as with tram cars, says Hilander. Instead of furnishing powder to the men, the company now sells it to them; only about half as much powder is used. Mill-level tunnel has been completely gunnited with one-half inch of concrete, which eliminates the rock condition. Concrete was applied under pressure to 5,000 ft of the mill level and 2,000 feet of the Montana.

Track is being regraded so it will be uniform, and has been ballasted with crushed material. 40-lb rail is being replaced with 60-lb. Curves will be banked for 20-mile haulage.

Capacity will be 1400 tpd, and possibly 1500, or twice the previous tonnage.

Even with tonnage about twice what it was before, the company plans to operate with about 325 men while before they employed 285.

Mill should be ready in October and the company hopes to be operating at full capacity by the first of the year.

Grand Junction operations office has announced that an engineer of its mining division is now available at Salt Lake City, Utah, to serve the public in matters dealing with uranium mining and ore

Use this Wire Rope on your toughest mining job—it's made to meet your needs!

Wherever you use Wire Rope—for scraper loaders, mine hoists, draglines, strip shovels, on mining machinery—you'll find MONARCH WHYTE STRAND Ropes have the toughness and flexibility to give you longer heavy-duty service at lower cost. These Ropes are *designed* to serve well under the toughest going—built to fit *your* needs and service conditions.

MONARCH WHYTE STRAND wire ropes have all the quality features it takes to give you outstanding service. They are supplied PREformed and Internally Lubricated to resist abrasion, corrosion, and internal friction. These Macwhyte Mining Ropes are available in every wire rope classification.

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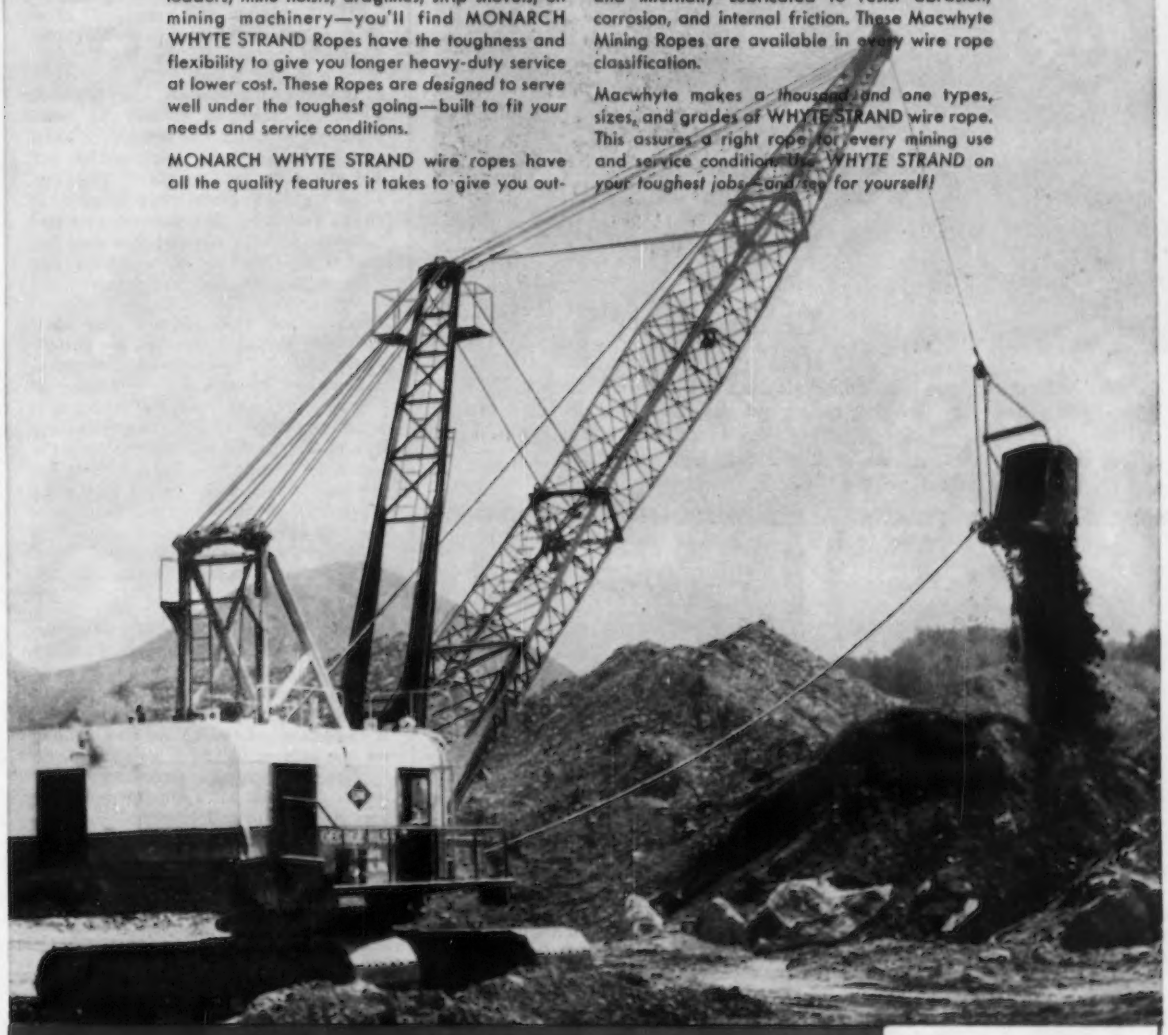

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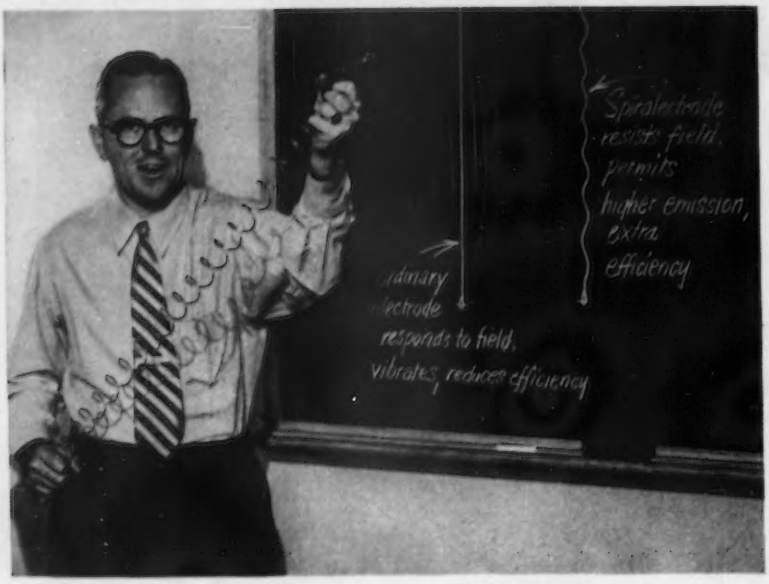
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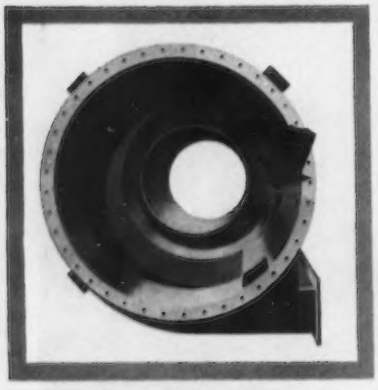

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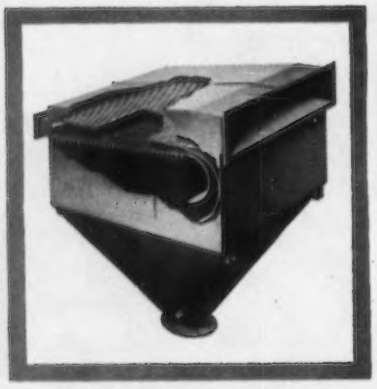

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Colorado *(Continued)*

procurement. William J. Egan, for the last year and a half an engineer in the Grand Junction mining division, is in charge of the office.

Stan Balcomb, president and general manager of the Double BG Exploration and Development Co. Inc., Colorado Springs, announced that negotiations have been completed to purchase the Raye Benham mine and claims in the Gateway mining district. Property consists of three claims with shipments having been made from three of the four known rim outcrops of uranium and vanadium. Purchase price was indicated in the neighborhood of $20,000.

First load of uranium ore from Marshall Creek in Saguache County 12 miles southwest of Salida was shipped. Owners of the mine are S. A. Jewett and his son, Russell, both of Pueblo. The ore, which is high grade, was shipped to Grand Junction. The senior Jewett said that it is primary ore and that they had been working most of the winter and had a couple hundred feet of diggings.

Golden Cycle Corp. during 1954 operated only the Ajax mine in the Cripple Creek district. It also owns the Anchoria Leland and Index mines. A portion of the ore shipped from the Ajax mine came from the Black Diamond claim owned by the United Gold Mines Co. leased to Golden Cycle Corp. Some dump ore was shipped from owned properties, other from leased properties. Total mine ore production from the Ajax mine in 1954 was 26,807 tons with a gross value of $1,045,344 and an average per ton value of $39.

New-Mar Uranium Corp. is pushing development of the Cherokee shaft on Beaver Mesa in the Gateway mining district. Shaft, which was financed with the aid of Cherokee Utah Uranium Corp., is completed. By means of core drilling on one acre of the 50 acres under lease by Cherokee Utah it is estimated that the orebody reached will approximate 19,400 tons of uranium and vanadium ore with an estimated money value of $1,123,648.

Under terms of the mining contract, New-Mar will receive 50% of the sale price of this ore while Cherokee Utah will receive 20% and other outside interests 30%.

Trend of lower gold receipts and higher silver receipts at the Denver mint continued in April, according to mint officials. Gold receipts last month totaled 52,237 oz worth $1,828,319 compared with 80,622 oz worth $2,821,799 in April 1954. Silver receipts were up to 611,592 oz valued at $553,479 from 262,000 oz worth $237,055.

At the meeting of the Clear Creek Metal Mining Assn., Norman Miner, who is operating the Mohawk group near Georgetown, reported over 200 oz silver, 25% lead and 2 to 3 oz gold in his recent strike. On the old Kelley, back of the Donaldson group, Earl Cronk reported a late assay from a streak showing 423 oz

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Now with 103 Drawbar HP

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Colorado *(Continued)*

gold to the ton. Reported shipping was the Jo Reynolds group including the Two Sisters.

Homestake Mining Co. management continues to hold a conservative estimate of future profits from uranium. A cautionary note ran throughout the remarks of president Donald H. McLaughlin at the annual meeting of Homestake shareholders. Tonnage and grade of uranium ore at Homestake's Little Beaver property on the Colorado Plateau is running a little better than anticipated he told the gathering. But Little Beaver is not likely to pay out in terms that would be large for a company with 2-million shares outstanding, he added. As an orebody, Little Beaver is relatively small. The orebody in the LaSal uranium mine in Colorado is living up to expectations and the grade is quite satisfactory, McLaughlin said. "I am optimistic that we will make a substantial amount of money from that orebody. But it is a small thing when compared with our big earnings from gold mining."

Gulf Coast Western Oil Co. of Oklahoma City, Okla., entered the uranium field with purchase of 19 claims on Uranium Peak, 17 miles north and east of Meeker.

Company announcement said Gulf Coast had agreed to pay the Devereaux brothers and F. A. Brown of Meeker $350,000 for the property, which has been under development for four years. About 1,000 tons of uranium-vanadium ore has been shipped from the claims.

Discovery of a high-grade barite deposit on the Dolores River above Gateway has been disclosed by Emery D. Strode and Allen E. Strode, brothers who live at Mack.

Strodes made a 40-ton shipment in May to the Great Western Sugar Co. plant at Johnstown, Colo., receiving $15 a ton.

Four Corners Uranium Corp. disclosed in May discovery of a uranium strike at Morrison, 12 miles west of Denver, which may be worth "several million dollars."

Discovery was made by Stanley H. and Robert Stauss, prospector brothers, last year. Four Corners obtained an option last fall, paying the brothers $8,000 cash and 7,000 shares of Four Corners stock.

Drilling now has revealed an orebody that president E. H. Sanders says "might well prove to be the big bonanza discovery for Four Corners."

Some ore from core drillings has assayed as high as 1.66% uranium oxide, Saunders said. Production is expected by mid-July.

New Idria Mining and Chemical Co. announced in May it had acquired about 1,120 acres of uranium properties in Mesa and Grand Counties, Colo.

The claims include both proven and undeveloped areas, New Idria said. Seller was identified as a San Antonio, Texas, uranium engineer.

2¼-yd. MICHIGAN 175A fills hopper with crude ore rock . . .

This big POWERHOUSE handles bigger jobs cheaper!

Check the specs of the MICHIGAN* 175A:

BUCKET CAPACITY..... 2¼ yds.
WEIGHT..... 24,100 lbs.
LIFTING CAPACITY..... 15,000 lbs.
SPEED . . Up to 27 mph, Forward and Reverse
HORSEPOWER..... 133 Diesel, 126 Gas, 165 Supercharged

Don't look for "comparative" data on the MICHIGAN 175A—there is *no machine comparable.* This big bruiser is nearly 50% bigger than the next closest machine on the market. From flywheel to bucket, the 175A is built to do bigger, heavier jobs—jobs that no other rubber-tired machine can handle.

Better traction and flotation With the MICHIGAN's exclusive power train—300% torque multiplication, power shift transmission (no engine clutch) and planetary wheel axles—you get a shockless flow of power right down to the ground. There's no surge, no wind-up in the axle shaft, no wild wheel-spin. The operator has feather-touch control over his wheels; in weak soil conditions or mud, he can ease off or step up the power to keep from digging in. With this kind of smooth power transmission, you get the full advantage of the MICHIGAN's extra weight and power—you dig material *out*, you don't dig the machine *in*.

Hydraulic power does the work In spite of its size and power, the MICHIGAN 175A is easier to operate than most machines one-third its size. Hydraulic power does all the real work: power steering, 4-wheel power brakes, power-shifting with two simple levers on the steering column, no clutch pedal.

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TISCO Manganese Steel has been famous for many years among mining and stone products concerns for its durability in wear parts of crushers, power shovels, conveyors and other equipment subject to impact and abrasion.

Taylor-Wharton specializes in wear-resistant alloys for heavy duty applications. Among its newer products is TISCO 150-Y, a high chrome cast iron that can be heat treated to 700 Brinell. This material stands up well under severe abrasion, where impact is not a factor.

Another excellent alloy is TISCO 50, a heat hardenable medium manganese chrome molybdenum steel capable of hardness from 300 to 500 Brinell. It is recommended where abrasion with moderate impact are encountered.

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Use TIMANG Weld Rods and Shapes for rebuilding and repairing wear parts.

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Colorado (*Continued*)

Purchase price was in excess of $1-million in cash and stock, New Idria officials said.

Willow Creek Mining Co., Inc., has taken over operation of a rare earth's mine nine miles north of Parlin in Gunnison County. Mine has commercial deposits of mica, columbium, musconite and beryllium. Total production last year was estimated at about $40,000.

Rico-Argentine Mining Co. expects to have its $1.5-million sulphuric acid plant at Rico in operation by Aug. 1. Entire output of the plant, which will produce sulphuric acid from iron pyrite, will be used by uranium mills on the Colorado Plateau.

IDAHO

Silver Buckle Mining Co. has suspended operations temporarily at the Vindicator Silver-Lead project in the east end of the Coeur d'Alene District near Mullan, pending completion of negotiations for additional property in the area and study of geological information obtained during the course of the recent deep-level exploration.

Officials said the 750-ft level east drift exposed 250 ft of good lead-silver mineralization, considered sufficiently encouraging to warrant deeper development.

Bradley Mining Co. is expanding production about 10% this year at its Ima tungsten mine in Lemhi County near Patterson. Executive vice president John D. Bradley said that exploration and development work is continually finding new ore and the mine is now producing about 200 tpd ore, with about 100 men employed. Monthly output of the concentrator is about 2,500 20-lb units of tungsten trioxide.

Highly radioactive ore containing both uranium and thorium has been found on Hall Mountain in northern Boundary County near the Canadian border, and a rush for claims in the area is reported to be in progress.

Initial find was made by three Spokane, Wash., prospectors—Charles R. Greear, Clarence H. Sheldon and Karl C. Fair—on the dump of the old Golden Sceptre property four miles east of Porthill and they subsequently found ore in place in an old upper tunnel. It is associated with a jasperized material adjacent to a strong fault.

The prospectors, along with three other Spokane men, have leased additional acreage and located another 10 claims in the immediate vicinity, adjoining the nine-claim Golden Sceptre group which they hold under lease. The group has organized Northwest Prospecting & Development Co. to undertake development of the find and surface bulldozing above the tunnel to locate the vein outcrop is already under way.

Bunker Hill & Sullivan Mining & Con-

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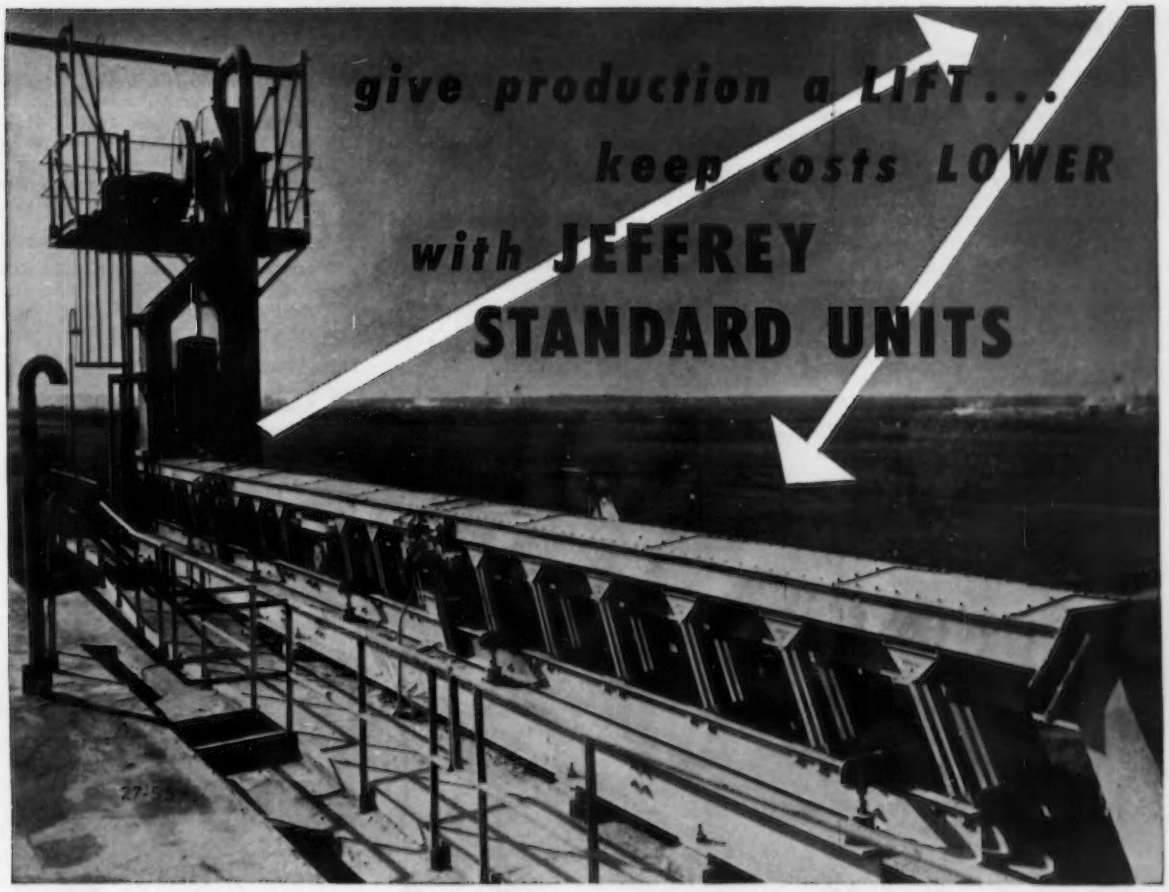

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Jeffrey flexible standard units provide almost limitless combinations to meet industrial conveying and processing requirements.

At the plant shown above, a Bucket Elevator lifts material to a Mechanical Vibrating Conveyor which delivers to silos. Also at work at this installation are Jeffrey Electric Vibrating Feeders, Spiral Conveyors, Weigh Feeders and Crushers.

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Idaho *(Continued)*

centrating Co. reported recently that the Emery vein has been opened on the new 27 level, 1200 ft below sea-level, and contains ore just as good and just as rich as on the 25 level 200 ft above. About 150 ft of drifting on the structure has shown it to be equally strong on the new level with no indications that the bottom of commercial mineralization has been reached. Values are in lead and silver, with some zinc. 27 level crosscut is now being continued toward the Truman-Ike vein which is located several hundred feet from the Emery.

At the company's Crescent property on Big Creek, the 3200-ft level west drift on the Alhambra fault-vein is being continued. About one-third of the first 700 ft of vein exposed was in silver-copper ore. Crescent work is a Defense Minerals Exploration project which included deepening the shaft from the 1200 to the 3200 level.

Mine production in the Coeur d'Alene District declined in 1954 for the third consecutive year, according to reports filed with the Shoshone County Assessor. Output last year by 27 mining and 15 leasing operations totaled 1,496,325 tons with a gross value of $39,407,917, as compared with 1,585,405 tons valued at $40,537,717 in 1953 and the recent high of 1,960,892 tons worth $59,893,199 in 1951.

Bunker Hill continued as the district's largest producer with an output of 413,740 tons worth $12,263,354. Ranking second was Sullivan Mining Company's Star mine at Burke. Its 1954 production totaled 216,798 tons with a value of $6,293,802.

Five companies—Bunker Hill, American Smelting and Refining Co., Hecla, Sunshine and Polaris—accounted for 85% of the district's 1954 tonnage and 88% of gross value of production.

Three Wallace, Idaho firms—Uranium Mines, Inc., Western Silver-Lead Corp., and Square Deal Mining and Milling Co.—have started exploratory drilling on their jointly-owned Phoenix property in the Big Indian District of San Juan County, Utah. Apex Exploration Co., a drill contracting firm, is doing the work. Initial program calls for three holes to 700 ft in the area where three out of four holes drilled by previous owners encountered ore. Two holes will be off-sets to gain further information about deposit and the other will be a step-out to determine its trend. Results of the initial program will determine what the next phase of exploration will be.

Uranium Mines has a 50% interest in the project and the other two companies each have 25%. Previous owners retain royalty rights on a graduated scale depending upon ore values.

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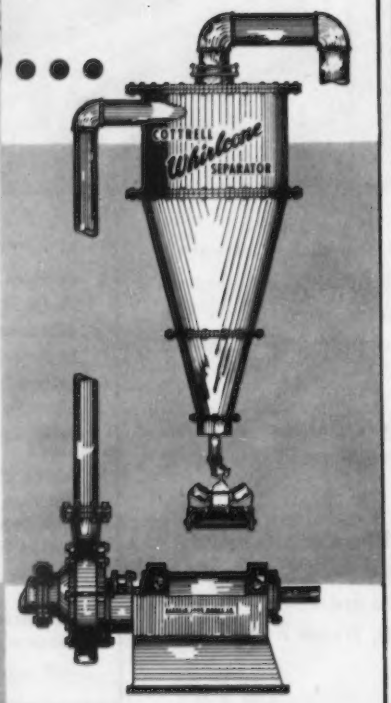

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MINNESOTA

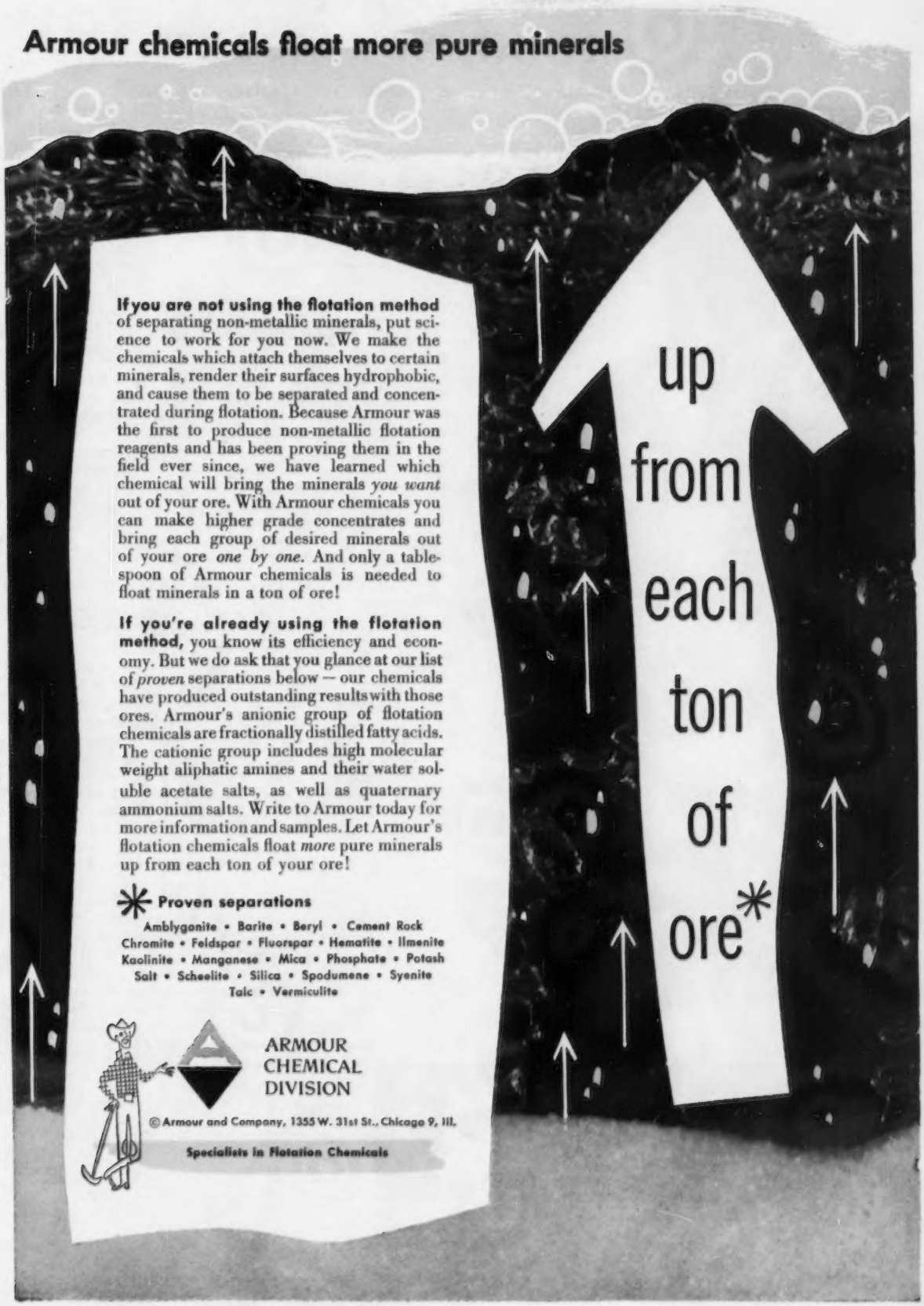
On its first load of ore for the 1955 season the George M. Humphrey of the M. A. Hanna Co. fleet took on 20,900 tons for Cleveland, Ohio. On Oct. 21, 1954, the Humphrey loaded 22,605 tons: a record for a Great Lakes cargo of iron ore.

M. A. Hanna has begun developing their Parcel No. 3 mine, north of Coleraine and about one mile east of the Buckeye mine (which was closed indefinitely at the end of the 1954 season). A washing plant with heavy density units will be constructed and the mine is scheduled to produce ore in 1956. It contains an estimated tonnage of 4,806,000 tons.

Sault Ste. Marie canal was officially opened for boat traffic one hundred years ago: on June 18, 1855. First load of iron ore to pass through the new waterway was carried by the brig Columbia, and consisted of 100 tons of ore loaded at Marquette, Mich., by the Cleveland Iron Mining Co. and was consigned to Cleveland. In 1953, 95,844,449 tons of iron ore passed through the canal's locks.

May meeting of the Minerals Beneficiation subsection of the Minnesota section of the AIME was held in Hibbing on May 4. Luther Hendrickson of the Oliver iron mining division, Mountain Iron, was in charge of the program. Principal speaker was Milton Williams of the

Armour chemicals float more pure minerals



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Square conditioner tank improves flotation floorplans

The Wemco Conditioner is most commonly furnished in a square tank of the same dimensions as a Wemco Fagergren Flotation Machine. It fits neatly in line with the flotation machines that follow it. Aisles can be straight and uniform. Total floorspace requirements are reduced to a minimum and plant operation is simplified. (Round tank units are available if desired.)

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Minnesota *(Cont'nued)*

Oliver research laboratory, Duluth, who told of his recent trip to Africa.

M. A. Hanna's South Agnew and Morton mines, which shipped 931,260 tons in 1954, are scheduled to produce about 1½-million tons in 1955.

Charleson Iron Mining Co. has resumed production from its concentration plant in Virginia. It treats ores from the Misabe Mountain and Minnewas lean ore stockpiles. Both were former Oliver iron mining division operations.

Rhude & Fryberger are building a washing plant at their Troy mine near Eveleth. The mine shipped 53,327 tons in 1954. As of May 1, 1955, there was an estimated tonnage of 618,322 tons remaining in the property.

Iron Ore Company of Canada has begun its first full year of shipping from its Labrador mines. First shipments were made in August 1954, with about 1¾-million tons being produced in the 1954 season.

Only underground iron mine now active in the Hibbing-Chisholm district is the Agnew mine of the Cleveland-Cliffs Iron Co. Company also operates five open pit mines on the Mesabi.

For the week ended May 23, 1955, 2,819,537 tons of iron ore were shipped from the Lake Superior district. Total season shipments to that date were 11,853,877 tons as compared to 8,417,798 tons for the same date in 1954. With favorable fall weather for washing plants it would be quite possible to attain the 80-million tons that some predict if weekly shipments equal or slightly exceed those for the week ended May 23.

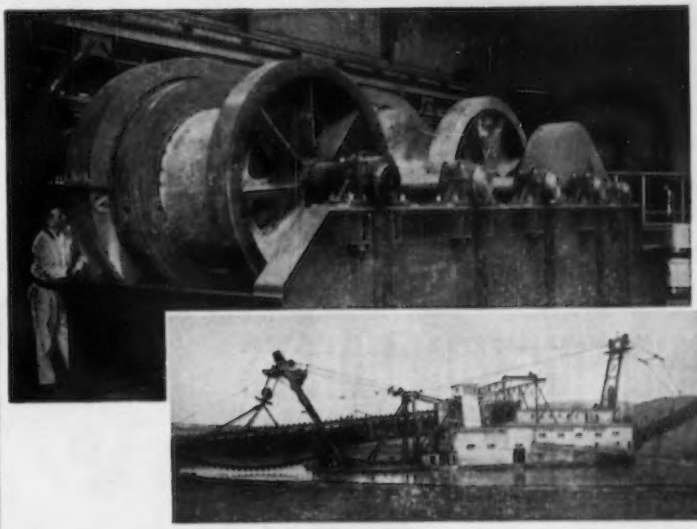
MICHIGAN

It was announced in early May that the Spies mine of the Cleveland-Cliffs Iron Co. would be closed "in about one month." There have been complaints from the Michigan Health Department of sulphuric odors emanating from the mine. Shaft will be capped and sealed off. For some years the Spies has had trouble with sulphur fires from spontaneous combustion. There have been four sulphur fires in the last fifteen years.

Sherwood mine of the Inland Steel Co. at Iron River has begun the development of a 1,000-ft, 16-degree slope from its 1200 level to the 1400 level. The incline will be used for a belt conveyor which will bring ore from the 1400-ft level to the 1200 for hoisting to surface. Repairing of Sherwood's air shaft, which also serves as an escape route, has been completed. Rock walls have been gunited to prevent further enlargement of the raise through spalling action of the rock.

New $750,000 ore research center, nearing completion at Michigan College of Mining & Technology in Houghton, is expected to be in operation in about one

YUBA-BUILT HOISTS
Lift 1000-Ton Loads



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This YUBA-built double-drum dredge hoist is designed to handle 194-foot digging ladder and is capable of lifting 800 to 1000 tons. Single-drum hoist (bottom) built by YUBA for tramway carries 5200 feet of wire rope. We're old hands at building such machinery. Every bucket ladder dredge Yuba has built combines many special "machines"—hoists, conveyors, drives, screening and metal saving equipment, winches, pumps —all designed and built by Yuba.

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YUBA's manufacturing experience includes grooved drums for large gate hoists, barges, steel and chemical plant equipment, construction rigs, clamshell buckets, ordnance, other custom work, and structural steel production. Parts for field assembly are fitted and match-marked before shipment to insure accuracy.

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Michigan *(Continued)*

year. It will help to develop new processes for treating the millions of tons of low grade ores—both iron and copper—known to exist in the upper peninsula. Professor N. H. Manderfield will plan and direct the center. It will collaborate with mining company research departments in developing new methods and equipment.

Pickands, Mather & Co.'s Sunday lake mine at Wakefield has moved its main ventilation fan from the 27 to the 28 level to better service the lower areas of the mine. Due to long planning and completion of all preliminary work in advance, the move was made in two or three days without interrupting normal mining operations.

The 150,000-cu ft capacity fan is at present handling about 65,000 cfm.

MONTANA

U. S. Atomic Energy Commission under the Salt Lake exploration branch of the division of raw materials is opening an office in Spokane, Wash., which will be in charge of Hubert W. Norman, recently assigned to the Coeur d'Alene, Idaho office of the division. Spokane area has been serviced for the past three years by the Butte sub-office and will continue to be under the general supervision of Leonard D. Jarrard, chief of the Butte office.

William J. Van Matre, Butte, has taken leases on a group of claims carrying columbium-tantalite and monazite values in the Sheep Creek area of Ravalli County. Claims were leased from members of the Lee Shook family, Conner, and Louis Erickson of Corvallis, both in Ravalli County.

Montana Phosphate Products Co., as a result of favorable exploration in recent years, will materially expand operations at its Anderson Mine near Garrison, Powell County, and build a 5-mile railroad extension from the main line of the Northern Pacific Railway (from the "Phosphate Siding") up Brock Creek to a point where the roads from the Anderson Mine and the Relyea Mine meet.

Extension will cost about $500,000, is being built by the Northern Pacific Railway, and will materially lower the transportation costs of the company.

Phosphate company will develop a low-level underground haulage by means of a 10,700-ft crosscut adit, to be driven to the phosphate bed from a point in Brock Creek Valley, three miles south of and at an elevation 600 ft below the collar of the present Anderson shaft.

Serviceway, inclined at 60 degrees, will be raised 700 ft initially from the end of the adit to open three upper levels on the ore bed. Ore from these upper levels will be dropped to the main haulage level and brought to the surface through the new adit in trains of 100-ton capacity. Brock Creek adit will become the main center of activities in the Anderson Mine area, and surface buildings are being erected in that vicinity. When the new haulage tunnel is completed, in 1957, the mine will produce at the rate of 1,000 tpd of phosphate rock.

Fred E. Burnet, recently elected president of the Mining Association of Montana, is operating superintendent for the company, and A. E. Langston is mine superintendent. Norman Aked is mine accountant and Dr. L. V. Bell is district geologist. R. B. Shelledy, Spokane, recently retired as president of the company but was retained as a consulting engineer. The Montana company is owned by Consolidated Mining and Smelting Company, Ltd., of Canada.

NEVADA

Drilling on 75 uranium claims in the Bald Mountain district near Yerington has been started by Cal Vada Mining Co. Heavy equipment has been working on the site during the last several weeks, and a large expenditure is planned by the company in order to determine location and potential value of the ore, which is currently reported to be of good commercial grade.

Details of the new 175-ton barite mill to

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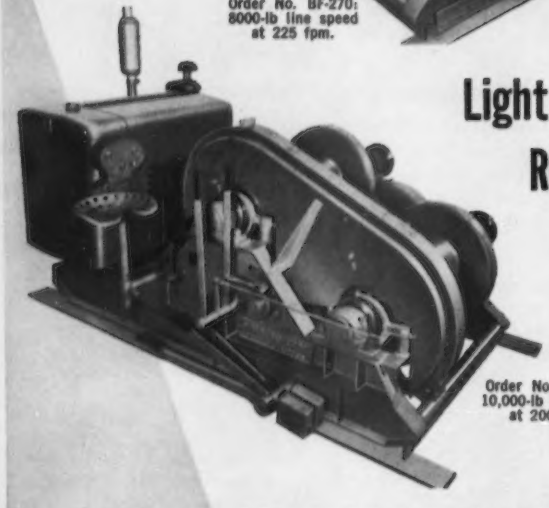

Order No. BF-280: 10,000-lb line speed at 200 fpm.

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Nevada *(Continued)*

be erected by the Magnet Cove Barium Corp. at Battle Mountain have been released, and final plans have been drafted prior to construction. Mill will be an all-steel structure 60x140 ft, and a brick office building 24x40 ft will be constructed nearby. Buildings will be on a 23-acre tract which has been cleared and prepared for work. Foundations are now being poured. Ore will be brought from the Graystone Mine leased last year from Lee, Dyer, Hand and Layton, and from other properties nearby now controlled by Magnet Cove. It is estimated that 30 men will be employed at the mill following completion.

Extensive study of all ore deposits in Lincoln County will be started in July by the U. S. Geological Survey, looking into the possibility of opening up new mining operations. Director William E. Wrather said a team of geologists would carry on the work, and that the surveys are expected to continue for two or three years.

Nevada-Utah Uranium and Oil Corp. has launched an exploration and development program on 21 uranium claims in the Red-Rock area north of Reno, and according to Elmer G. Jones, vice president and director in charge of operations, an expenditure of $75,000 is planned on the project. A grid test of the entire area will be made with scintillators, and heavy equipment will be moved onto the site. A road has been built to the property and a mine tunnel has been sunk to some depth. Some surface samples have assayed 0.47% uranium oxide in the autonite and carnotite ores.

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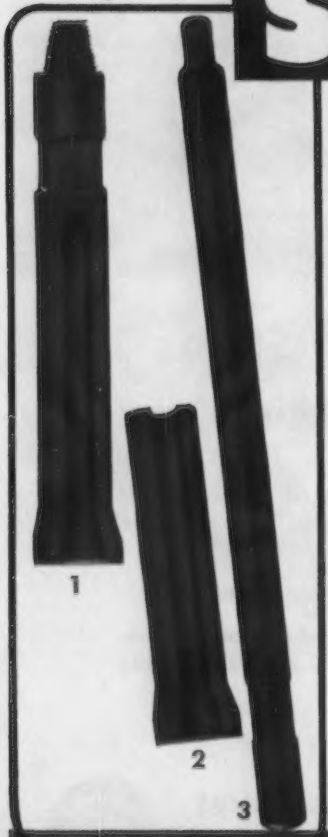

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NEW MEXICO

H. P. Slagel, Utah oil operator, has filed 15,557 acres of New Mexico state potash leases in Lea County. Associated with Slagel in the filing were retired Brig. Gen. Frederick L. Anderson, Palo Alto, Calif., and Lee Van Atta, Dallas, Tex.

Sabre Uranium Corp. announced in June purchase of New Mexico uranium properties that almost double Sabre's previous holdings.

Hugh Craigie, Sabre president, said the company had paid more than $400,000 for property including 18 sections of land in McKinley County, and one section plus 72 claims in the Canoncito area.

Sellers were a Santa Fe group including Richard D. Bokum, C. G. Warren and Victor Salazar.

Sabre expected to start drilling its new holdings by July 1.

NORTH CAROLINA

Plans for mining and concentrating of kyanite in the Craigmont section between Crowders and Kings Mountain, have been announced by J. E. Herndon, of Kings Mountain, vice president of Carolina Mines, Inc., which was organized recently.

Firm will mine kyanite-bearing ore from 261.5 acres it owns and leases in the area. Harry J. Wolf, New York mining engineer and consultant, has examined the properties and recommended the mining venture.

Herndon says the company now is negotiating with manufacturers for equipment to be used in the concentrating plant.

Officers are A. S. McSulloch of Vancouver, B. C., president and treasurer; Herndon, vice president; J. R. Davis of Kings Mountain, secretary; J. B. Hamilton of Vancouver, assistant treasurer; and J. J. Mullinax of Kings Mountain, assistant secretary.

OREGON

Oregon Department of Geology and Mineral Industries' current issue of *Ore.-Bin* features a summary of Wallowa mountains geology compiled by N. S. Wagner, department geologist, prepared to aid uranium prospecting in the northeastern Oregon sector during the current field seasons. This activity is expected to reach unprecedented scope throughout the state,

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Oregon *(Continued)*

particularly in eastern Oregon.

The Wallowas are an old mining region. Activity in recent years has been limited, particularly in the gold lode claims, although limestone quarrying is carried on extensively. The range embraces areas of three counties—Baker, Union and Wallowa—and portions of Idaho.

Hydraulic operations on the north fork of Galice creek gold claims of the Evergreen Mining Co. have been suspended by Wes Pieren and Antone J. Nilson because of regulations of the Rogue River Coordination Board and fishing season code. Pieren reports gravels in the old channel occurrences were averaging 5 ft in thickness and barren overburden averaged 14 ft. During operations one small platinum nugget was found; several gold nuggets in the 100 oz sluice cleanup weighed more than 1½ oz.

Horseheaven mine east of Ashwood in Jefferson County, operated by Cordero Mining Co., has placed its 25-ton rotating furnace for roasting cinnabar in operation on a three shift per day schedule. Surface building were destroyed by fire in 1944 and the mine idled until reactivation the past winter. A crew of 12 to 15 is employed in the furnace, mining and development operation. Production has averaged four flasks of mercury per day at last report in late May.

Current activities and recent operations at Bureau of Mines laboratory at Albany have been reported by regional director Stephen M. Shelton.

Basic research on liquid-liquid separation of the rare earth elements and of tantalum and columbium is being conducted. Related studies on columbium and tantalum include investigations of methods of chlorination, development of analytical methods for determination of these elements, and investigations into the extraction and separation of tantalum and columbium from low-grade ores and materials. In carrying out these studies, the experience gained in the laboratory's work on the production of zirconium is playing a valuable part. Although research designed to improve zirconium production techniques also is being conducted, actual large scale production of zirconium for the Atomic Energy Commission has been turned over to private industry and such work at the station is being terminated.

Recent innovations have been made in the Kroll process for zirconium production. One new technique that should reduce costs is the use of a thin steel liner inside the reduction crucible. After reduction, the liner can be stripped from the reduction mass, the bulk of the by-product magnesium chloride can be separated, and the zirconium reguli from several reductions can be combined for distillation.

Under the sponsorship of the Atomic Energy Commission and the Reactor Division of the Navy's Bureau of Ships, development work on the fusion of rare and highly reactive metals, particularly zirconium and hafnium, has been conducted. The method developed for the production of zirconium alloy ingot now has been generally accepted by the titanium industry for that important metal. The recent announcement by Bureau scientists of a new technique for casting titanium metals has alerted the rare metals foundry trade to new possibilities in the production of shapes. Other pioneering work in melting includes the arc melting of malleable chromium and its alloys.

A process is being investigated for the production of bismuth by the fused salt electrolysis of bismuth trichloride in a potassium chloride-lithium chloride carrier salt. A molten bismuth cathode and a graphite anode are employed. Current efficiencies near 100% are obtained, and the cell is capable of continuous operation.

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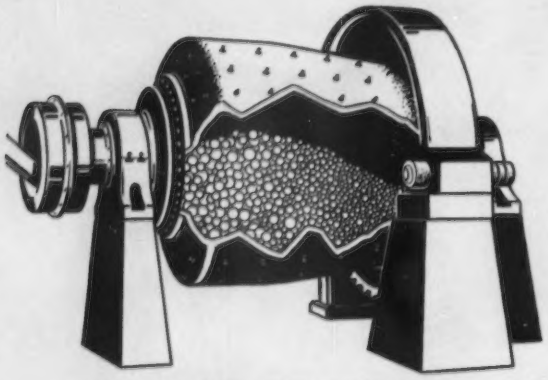

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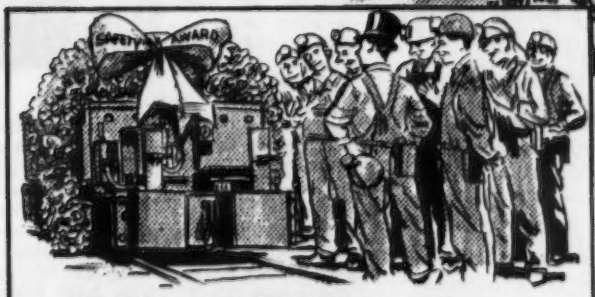

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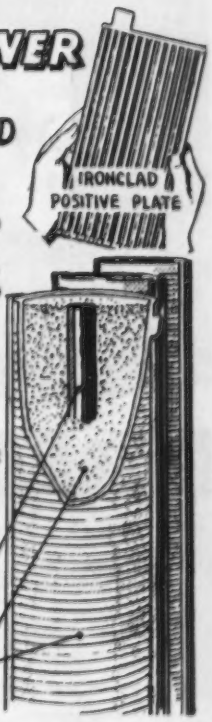

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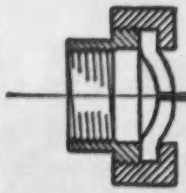

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TEXAS

AEC is reportedly investigating a new discovery of uranium in Brewster County. Ore is described by one observer as being of "primary" type.

PENNSYLVANIA

Heppenstall Co., Pittsburgh, is forging uranium in the form of ingots. Uranium is heated to forging temperature in a salt bath, according to company spokesmen, and placed in a 1,000-ton-capacity press. After forging, metal is quenched in water to prevent oxidation. Uranium, says Heppenstall, is a soft metal about 2½ times heavier than steel.

UTAH

The struggle to receive a nod from the Atomic Energy Commission for a mill at Greenriver is warming up.

United States Vanadium Corp. already has acquired 153 acres across the Green River for its proposed mills—has had talks with the Commission.

Odlum

Floyd B. Odlum, Atlas Corp. president, has made flying trips to Grand Junction and Washington, D. C., on the matter—has formally announced that he has "started negotiations" with the Commission.

Odlum seeks a mill for his Atlas Corp.'s Hidden Splendor Mining Co. ores. (And he wants a mill at Moab for Federal Uranium Corp.)

Odlum conferred May 20 with officials of the Grand Junction Operations Office of the AEC and disclosed plans to construct mills at Greenriver and Moab, Utah. Later in the month he met in Washington, D. C., with Jesse Johnson, AEC director of raw materials, and discussed use of nuclear power for the mills.

Odlum said he already has discussed the project with Westinghouse Electric Corp. and North American Aviation, Inc., both of whom are doing research on reactors.

Construction of the Greenriver mill may be under way by November, Odlum said. "The nuclear reactor can be installed before the mill is finished," the financier added. "Peacetime use of atomic energy is coming faster than people think."

The reactor being considered, Odlum said, would be capable of producing 5,000 kw for each ton of capacity, this would be enough power to operate two or three plants.

The reactor would be centrally located to serve the mills it would power.

The Greenriver mill proposed by Odlum would process ore from the Hidden Splendor mine, purchased last

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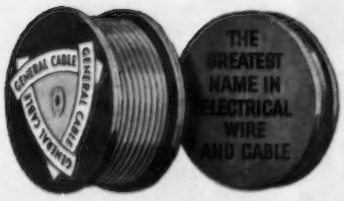

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Utah *(Continued)*

year from Vernon Pick for $9-million. It also would take care of ore from other mines in the area.

Meanwhile, Vitro Uranium Co., a division of Vitro Corporation of America, is in discussions with the AEC on this basis:

1. Expansion of the Salt Lake mill to handle a great amount of Temple Mountain and San Raphael Swell ores.
2. Establishment of a mill at Greenriver, if the AEC is wedded to location of a unit there. There is an argument there that it would be cheaper in the long run to ship by rail to Salt Lake facilities than to build an entirely new unit.

In connection with the Salt Lake mill expansion, Vitro this week obtained option on 200 acres of land near the Jordan River for a new tailings pond.

W. B. Hall, Vitro Uranium vice president and manager, said the ascquisition was in line with studies concerning expansion which would see a uranium operation in existence "well past 1962."

Col-U-Mex Uranium Corp. reports that Moab Drilling Co. is drilling the firm's No. 1 Columbia claim in Big Indian district in connection with the continuing prospect on holdings of Lisbon Uranium Corp. in same district.

Vanadium Corporation of America is constructing a two-compartment shaft off its Freedom No. 2 incline Ervin Walters, mine manager, reports at Marysvale.

The mine, now 1,000 ft deep, is producing at an estimated rate of 150 tons of uraninite and autunite ores daily. Shipments are to AEC sampler at Marysvale and thence to Vitro Corp.'s mill at Salt Lake City.

Thirty-eight men on one shift are working in the mine.

Charlie Steen's Utex Exploration Co. has commenced a 1700-ft drift at lower levels in the famous Mi Vida mine. The project also will permit easier exploitation of the neighboring Standard Uranium Corp.'s property where a portion of the mining is now being carried out by Utex.

Mining officials at Utex estimate about 25% of the Mi Vida orebody has now been mined out. This corresponds to about two full claims.

Uranium Prospectors Co., Ltd. (UPCo Ltd.), is sinking a two-compartment shaft on a substantial carnotite orebody about 17 miles west of Greenriver.

Thomas J. Ballard, mining engineer for the Patino-connected company, said drilling on 15 claims has uncovered some ore in channels up to 20 ft thick.

Eimco Corp. is developing a crawler loader capable of operating in low headroom for use in Hecla Mining Co.'s Radon Group operations in Big Indian District.

Hecla, now down about 60 ft in sinking three-compartment shaft, looks toward commencement of mucking machine installation which will carry shaft to projected 600 ft depth.

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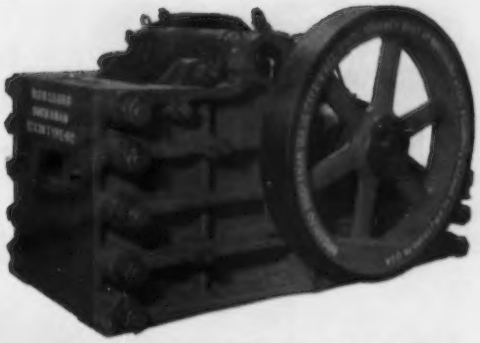

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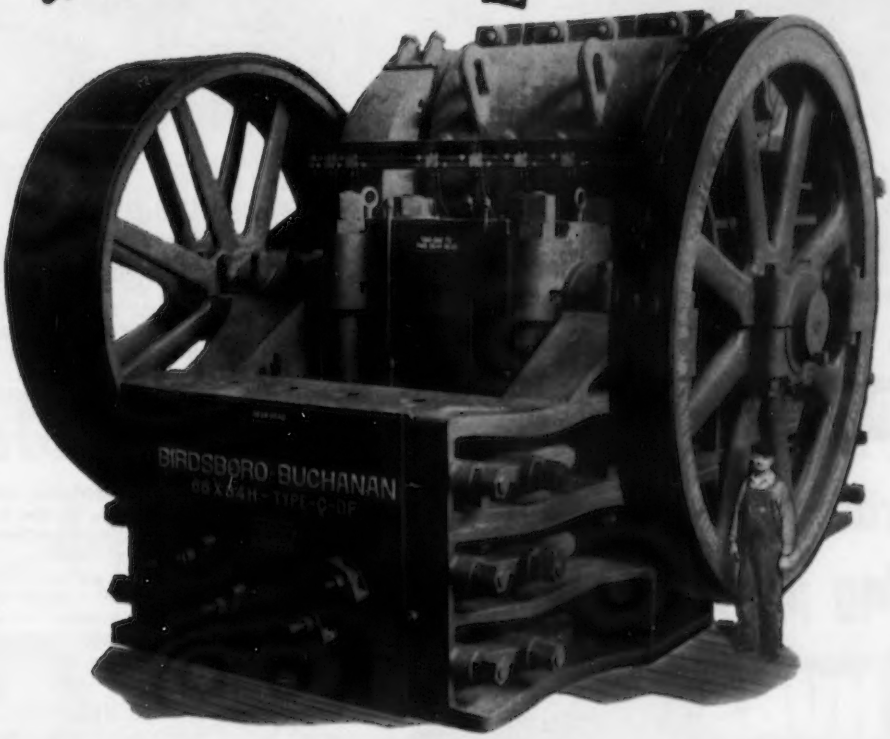

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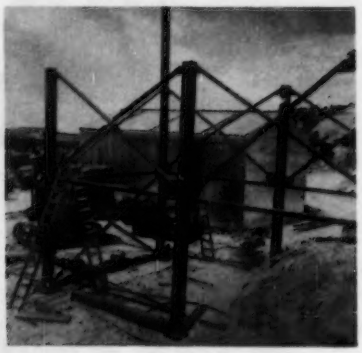
Utah *(Continued)*

facilities are now being completed. From 30-35 miners to be employed in operation will be housed in project being built for them in Moab, 30 miles distant.



The 75-ft head frame at the Hecla shaft shown as it was being started, is expected to reach the Radon orebody by late August.

A 200-ton ore bin was to be built into the head frame, Hecla employees said.

Hecla will exploit the Randon under an agreement with the Utah & Idaho Uranium Co., now part of Floyd Odlum's Federal Uranium Corp., under a profit sharing agreement.

Hecla hoped to sink the 650-ft shaft in 70 days. Orebody it will tap has been estimated to value not less than $20-million, and possibly much more.

E. L. Cord interests are negotiating with Centennial Development Co., Eureka, for sinking of a 600-ft three-compartment shaft on the "Cord Group" orebody.

The Big Indian District prospect now reportedly contains 500,000 tons of ore averaging 0.30 and 0.35 uranium oxide, says mining engineer George H. Teal. He is a former Boulder County, Colo., tungsten operator who represents Cord.

Merger-of-the-month for May, consummated in Colorado but affecting much Utah uranium property, was the transaction resulting in Midwest Consolidated Uranium Corp.

Companies involved include Midwest Uranium, Allied Uranium, Henry Mountain Uranium, Geronimo Uranium, Blue Mountain Uranium, World Uranium and Wildcat Uranium.

Mammoth new company, capitalized at $20-million, will have seven producing mines, including the Spook mine in White Canyon, San Juan County.

Midwest Consolidated plans both uranium and oil operations.

Norbute Corp. has announced purchase of an operating interest in the Ringtail uranium mine in the Yellow Cat area from Strategic Minerals Exploration Co.

The 640-acre Ringtail property, 17 miles south of Thompson, has been producing about 400 tons a month with assays averaging 0.30% uranium oxide and 1.50% vanadium.

Norbute, a William Zeckendorf company, also has extensive uranium holdings in Wyoming.

Prospecting with two Universal 'Jeeps', F. K. Campbell explores a 100,000-acre lease in the remote, rough Sierra Blanca mountains of West Texas. One 'Jeep' carries complete radiation detection and recording equipment—the other is equipped with drill and plow. 4-wheel drive takes these 'Jeeps' up and down steep hills, through sand, and over rough, rocky terrain.

Standard equipment for uranium prospectors ...4-wheel drive Universal 'Jeep'

Interior view shows compact arrangement of instruments in the 'Jeep'. The 4-wheel drive Universal 'Jeep' is readily adaptable to almost any exploration or prospecting need.

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Utah *(Continued)*

Nabob Silver-Lead Mines, Merger Mines Corp. and Bismark Mining Co., Idaho firms, have experienced exceptional success in initial exploration work on their two joint ventures in Utah. First shipment of ore from their Blanca property in Uintah County, 55 sacks of high-grade gathered from the surface, averaged 2.78% uranium oxide. Presence of the loose ore has convinced company geologists that a fissure vein traverses the claims, and further examination of the structure to determine its nature and extent is now in progress.

Commercial ore has also been encountered in the first two holes drilled on the firms' Dead Horse Point property in the Colorado River Canyon near Moab, and bulldozing on these claims has uncovered high-grade copper-uranium float.

C. C. Dunkle, vice president of Nabob, is managing the Blanca operation, and C. C. Hunter, president of Merger, is in charge of the Dead Horse Point project.

Merger of Big Indian Mines, Inc., into Standard Uranium Corp. was voted by Big Indian stockholders in May. Big Indian property includes a blocked-out body of high grade ore estimated at 111,000 tons, and a low-grade orebody estimated at 550,000 tons.

Big Indian stockholders received six shares of Standard to one of Big Indian in the merger.

Standard officials report the company now is producing 10,000 tons of ore a month.

Bids on contracts for 30,400 ft of drilling in the Circle Cliffs-San Rafael Swell areas of Garfield and Emery Counties were opened by the AEC's Grand Junction Operations Office June 27.

Drilling will test the validity of several guides to uranium ore in the Shinarump conglomerate, the AEC said.

Earlier in June the AEC opened bids for 4,000 ft of non-core drilling in Eagle County, Colo., and for 18,000 ft of core drilling in the Black Hills area of South Dakota and Wyoming.

Ladoric Mines, Ltd., has announced it has acquired leases on nearly 20,000 acres of state land in San Juan, Grand, Emery, Wayne and Garfield Counties.

Leases were purchased for cash and stock from Jesse H. Knight of Calgary, Canada, and Roy L. Tallant of Salt Lake City, Ladoric spokesmen said.

Abbott Charles of Grand Junction will represent Ladoric in the area.

Mountain Mesa Uranium Corp. has purchased all the outstanding stock of Cal Uranium Co., an A. B. Ruddock family corporation. (See *E&MJ*, May, p 73.)

Mountain Mesa's purchase was in connection with an arrangement with the syndicate headed by Maurice Yates and H. O. English. The two men hold a continuing option on purchase of the Almar Minerals Corp. and 700 other mining claims in the Big Indian district of San Juan County.

Ruddock

M. K. Ruddock, who subscribed to a joint statement by English and Yates, said the sale of the family properties did not mean the Ruddocks were "moving out of uranium."

The family group will continue active in both uranium and oil along the Colorado Plateau through their Southwestern Development Co., he said.

Almar Minerals' principal holdings are the 51% interest in the Daniel and Ruddock claims at north end of the Big Indian district.

Continental Uranium Inc. has been granted a DMEA loan for $34,000 for deep hole drilling on its Section 2 property, Big Indian district, near the find of a "considerable" uranium orebody.

WASHINGTON

Two mining operations got underway in Snohomish County in May, according to a report from Everett. Bear Creek Mining Co., subsidiary of Kennecott Copper

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Their dependable performance and high job availability, combined with big payload capacity and fast travel speeds, have made "Eucs" the preferred hauling equipment for open pit mines and quarries. Because they're built for tough off-the-highway service, Euclids make more profits for owners by cutting the cost of hauling stone, ore, overburden and waste material.

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Working at a large open-pit copper mine in Arizona, a fleet of 34-ton "Eucs" maintain high production at low operating and maintenance cost. Their dependable performance and high job availability make "Eucs" an important part of the profit picture on this and many other mine and quarry operations throughout the world.

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LONGYEAR INTRODUCES THE NEW "W" SERIES DRILL RODS

New Sizes Accepted as Standard by DCDMA and CDDA

The E. J. Longyear Company recently announced a complete line of drill rods developed to the new standards adopted by the Diamond Core Drill Manufacturers Association and the Canadian Diamond Drilling Association. Known as the "W" series, these rods will come in EW, AW, BW, and NW sizes. These new standards have now been recommended for worldwide acceptance.

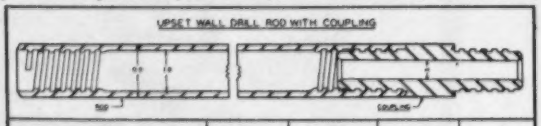
Field tests conducted by Longyear over a period of years indicate several distinct advantages to be provided by the "W" series rods. The over-all increase in size makes for a more stabilized drill string with less vibration and a minimum of ground caving. The increased inner diameter of the rod provides a larger water passage through the drill string and reduces pressure loss. The increased outer diameter reduces the area between the drill string and the hole wall which permits a more rapid return of sludge.

All Longyear rods, including the new "W" series, are made of cold drawn seamless steel tubing under closely controlled metallurgical conditions, thus assuring a uniform size and wall thickness with more than adequate strength and fatigue resistance for durability and efficient performance under all types of drilling conditions.

Change-over to the "W" series is expected to be gradual. In the meantime, Longyear will also manufacture the old standard E, A, B, and N drill rods and will supply the necessary important substitutes.

The new "W" series rods in all sizes are now available for immediate delivery. Specifications of "W" drill rods and couplings can be obtained by writing to E. J. Longyear Company, Foshay Tower, Minneapolis 2, Minnesota, U.S.A.

UPSET WALL DRILL ROD WITH COUPLING



Size of Rod and Coupling		EW	AW	BW	NW
Specifications	O.D. of Rod & Cplg.	1-3/8"	1-3/4"	2-1/8"	2-5/8"
	I.D. of Rod	1-1/16"	1-7/16"	1-13/16"	2-5/16"
	H Hole in Coupling	7/16"	5/8"	3/4"	1-3/8"
	Threads per inch	3	3	3	3
	Approx. wt. of 10' rod w/coupling	25.0 lbs.	33.6 lbs.	43.1 lbs.	55.3 lbs.

Our new "24" Jeep mounted drill

The "44" truck mounted drill

We clipped this news story when the "W" series was announced

INTRA-OFFICE MEMORANDUM

Longyear

TO: Gene Larson DATE: June 3, 1955

FROM: Mike Gleason PLACE: New Mexico

SUBJECT: Mobile Units

Save for scrapbook E.L.

Dear Gene --

Our new truck and Jeep mounted drills have really put the needed mobility into our contract operation! We can get a rig set up and operating in less than half the time usually needed!

By the way, we've had a lot of comment AND QUESTIONS on the mobile units. If you'll send us a supply of bulletins 24-J0 and 44-T0, we'll pass them out.

Thanks, M. Gleason

P. S. Right now, we're telling interested parties to write direct to Longyear in Minneapolis.

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E. J. Longyear Co. MINNEAPOLIS, MINNESOTA

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Washington *(Continued)*

Co., has a crew of 27 men searching for commercial quantities of copper and other minerals in Miner's ridge district, near Darrington. Because of heavy snows blocking trails of the upper Suiattle River area a helicopter was to bring in supplies and equipment. Exploratory work on a smaller scale was carried on in 1954. The other operation, that of Sunset Mining Co., will employ 25 men at its holdings on the north fork of the Skykomish River.

Phelps Dodge Corp., Douglas, Ariz., has leased 20,000 acres east of the Columbia River and north of the Spokane Indian Reservation, J. H. Leuthold, president of the Deer Park Timber Trust and Deer Park Pine Industry, Inc., announced. In addition, the company reportedly plans to prospect more than 4,000 acres of state lands in Stevens County, for uranium. Aerial prospecting was expected to start as soon as weather permitted. This was reported by Charles R. Kuzell, general manager from Douglas, Ariz. First work is to be done four miles northeast of the Midnite uranium mine just across the reservation boundary, it has been reported.

Dawn Mining Co., a subsidiary of Newmont Mining Corp., New York, which was organized recently to operate the Midnite uranium mine on the Spokane Indian Reservation, started tunneling operations early in May and resumed shipping from the original discovery cut, Robert J. Hundhausen, general manager, reported. Company installed a 500 cu-ft diesel air compressor, drilling machine, mucking machine, ore cars, track, air lines, water lines and other equipment, after announcing on April 21, that it would take over operations. Ten men are being employed at the property near Wellpinit in Stevens County. A prospect adit is being driven into the ridge in the southern part of the property to check on ore indicated by a diamond drill hole put down by the AEC. Intersection is expected at about 70 ft. Company also expects to continue with test hole drilling started by the AEC.

Earle B. Gibbs, a widely-known northeastern Washington mining man, has taken over operation of the Chewelah Copper Company's properties east of Chewelah in a profit-sharing agreement with the firm.

For several years, Chewelah Copper has been consolidating and rehabilitating properties at the old Eagle Mountain copper camp, including the United Copper and Amazon Mines. Gibbs previously reopened the old Bonanza Lead Mine near Colville in 1944 and reportedly recovered millions of dollars of ore from it.

John DeGraff, who was mine superintendent at the Bonanza, will be general mine superintendent for the Chewelah Copper properties. Ore will be trucked to the Bonanza mill north of Colville.

Washington State Parks & Recreation Commission has excluded uranium prospectors and miners from most of Mount

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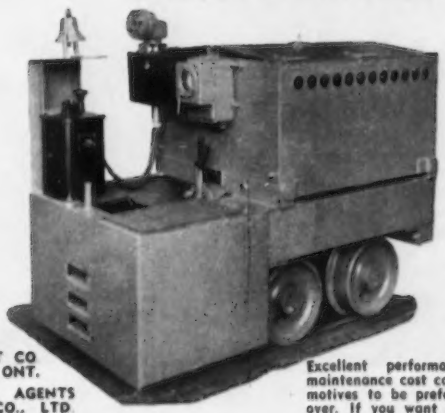

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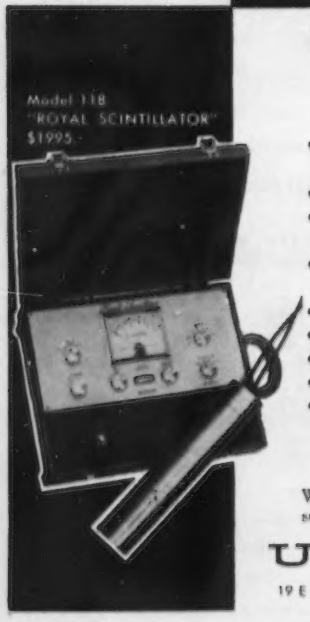

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Washington *(Continued)*

Spokane state park, northeast of Spokane. But the commission expects to open 8500 fringe acres for prospecting.

A tight vein of autunite has been uncovered by bulldozing on Indian Chief Uranium property on ranges 37 and 38 east of Stevens County. The bulldozers uncovered the vein in a granite-quartzite contact during a two-week period. The Indian Chief firm, operated by Sidney and Mascot mining companies, plans diamond drilling for further testing.

Officers include H. R. Crawford, president; Arthur E. Manteuffel, Spokane, vice president; and Byrl Goodwin, Spokane, secretary.

Crawford said the tight vein has been followed about 30 ft in either direction without finding an end.

New strike of uranium ore 1¼ miles northeast of the original find on the farm of Leonard A. Dahl has been announced by Lands, Inc., a recently-formed exploration company. New ore find consists of exposures of high grade autunite about 100 ft apart on land owned by the Dahls in the western foothills of Mount Spokane, 25 miles northeast of Spokane.

William D. Weaver, general manager of Lands, Inc., said he obtained a 20-year lease on 141 acres. The lease will be turned over to a company to be incorporated by G. C. LaDow, Harwood J. Tibbetts and R. Lowell Bell, who had retained Lands, Inc., to do exploration.

On another section of Dahl land, the newly-organized Daybreak Uranium, Inc., firm reports boring 55 ft into the ground without losing mineralization.

Daybreak holds an 80-acre lease on the Dahl property, where AEC is conducting the first deep drilling test of autunite ore veins. Daybreak began operations on April 28 with a bulldozer cutting into a uranium showing on one side of a low brushy ridge bordering a meadow.

In the first three hours, the 'dozer cut a swath 50 ft long and 6 ft deep, uncovering green autunite ore in the entire cut under about two feet of topsoil.

WYOMING

Shipment of 14 tons of ore from a new vein of the Sun Dog mine in the Crooks Gap area of southeastern Fremont County was announced by the Harrower brothers, owners. Norman Harrower said the new vein was 50 in. thick; some samples assayed at 0.25 to 1.5% uranium oxide.

Shipment of primary ore from the Pedro Mountains, east of the Seminole Dam in Carbon County, has been received at the ore-buying station at Riverton. Shipment of uraninite was from Little Man mine, operated by the Nugget Coal & Timber Co. of Denver, Colo.

Prospectors and landowners, not always on the best of terms, were to meet to-

"They *saved* us more than they *cost* us!"

That's what Pond Creek Mine says about O-B Automatic Couplers

During a power failure in a section of Pond Creek mine, a trip of seven loaded cars (6 tons each) and a 15-ton locomotive rolled 600 feet down a 3½ per cent grade and crashed into an identical trip of stationary cars.

Despite the force of the impact, only two cars required extensive repairs in the mine shop.

"In this one accident alone," says T. B. Bandy, Superintendent of Pond Creek Mine, "the rubber draft gear on our O-B Automatic Couplers saved us more than their original cost!"

Veteran miners at Pond Creek have seen how this rugged O-B Coupler cushions 50-ton coupling impacts, how it forces skewed cars into alignment on the track, how its self-centering head and 30 per cent wider gathering range eliminates trip riders and the hazards of stepping between cars.

Their continuing preference for the O-B Automatic coupler is a matter of record — a record of safety, production, and low maintenance.

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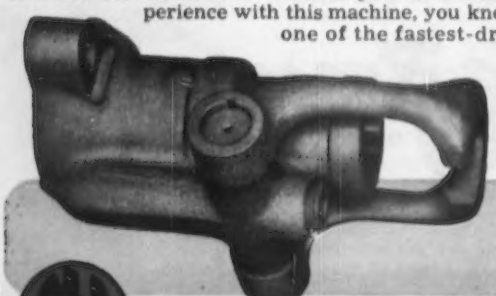
Here's why Cleveland Air Legs and Drills are easier to handle — Only Cleveland gives you an air leg and drill with a built-in 11-position feed control. It eliminates a third hose and cumbersome "Y" connections, reducing the weight a miner has to handle. No feed-control bleed valve is required either so that the operator doesn't have to bleed off air continuously to maintain suitable feeding pressure. And a new, quick-opening steel puller makes steel changing easier and faster.

Here's why Cleveland Air Legs and Drills have higher drilling speed — First of all, the Cleveland Air Leg uses the Cleveland H-10 drill. If you've had any experience with this machine, you know it's one of the fastest-drilling sinker drills made today. Then you have the built-in feed control that provides 11 feeding positions from zero to full-line pressure — with an increase of 9 psi at each setting. It lets the operator adjust the feed so that the drill is always down on the collar of the shank for maximum drilling speed, regardless of varying rock conditions.

Here's why Cleveland Air Legs and Drills stay underground longer — The Cleveland H10 drill is a proved performer, not only in the matter of drilling speed but also in upkeep cost. It's built to take it. And the Cleveland Air Leg holds the drill in line with the hole — thus reducing front-end drill wear and practically eliminating rotation strains. Moreover, the new steel puller helps to reduce maintenance costs still further. It consists of only five parts — there's only one spring and one plunger, and it's lubricated from the inside to prevent wear and to wash out dirt.

Four types available — There are four types of Cleveland Air Legs having conventional or telescopic, 3-ft., 4-ft., or 5-ft. feeds. Some models will take any 35-lb., 45-lb., or 55-lb. drill. Write for bulletin RD-30 that describes the Cleveland Air Leg in detail—the Air Leg that can help you get your rounds in faster for lower costs.

RD-65



Close-up view of new Cleveland Steel Puller. It consists of only 5 parts and has one spring and one plunger. Lubricated from the inside to assure easy operation and to flush out dirt, this new steel puller is also easy to assemble and disassemble.

CLEVELAND ROCK DRILL DIVISION
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Wyoming *(Continued)*

gether in Casper June 10 at a session arranged by the Wyoming Natural Resources Board.

Questions relative to uranium prospecting were to be answered by a panel including Edward Woozley, director of the Bureau of Land Management; Jesse C. Johnson, chief of the AEC's raw materials division, and Walter Waldeck of Montrose, Colo., national authority on mining law.

Uranium Corp. of America filed 976 claims in an area west of Hudson, Fremont County, in one week in May. Claims recorded in the county that week totaled 1,669.

Sale of 17,920 acres of mineral leases in the Pumpkin Buttes area was disclosed by the Flanders-Langford Mining Co. of Riverton.

Mack-Lang Uranium Corp. of Lander paid $89,600 for the leases, half in cash and half in Mack-Lang stock. Mack-Lang has begun mining operations on its 138 claims in the Crooks Gap area.

Kawecki Chemical Co. of Boyertown, Pa., is studying the feasibility of a native selenium ore processing plant in the Lysite area near Shoshoni.

Deposits in the Lysite area reportedly contain less than a half pound of selenium to a ton of rock.

Preliminary meetings have been held by Dr. Henry Fisk, chairman of the Natural Resources Research Institute at the University of Wyoming; Henry C. Kawecki, president and Henry E. Sivik, research engineer for the chemical firm.

IN CANADA

ONTARIO

Iron Bay Mines is investigating plans for production on its big magnetite deposit 20 miles south of the Red Lake gold camp. Extensive drilling and metallurgical testing have suggested a large scale open pit operation, with ore reserves adequate to provide 1-million tons of concentrates annually for 75 years. A premium product is visualized, grading 65% iron and 8.83% silica.

Shaft deepening to establish four new levels is being started by Nickel Rim Mines, nickel-copper producer on the east rim of the Sudbury basin. Opening will be taken down to 1300 ft from its present bottom at 776 ft. Schedule calls for the start of lateral work on the new horizons by late fall.

Two new lithium discoveries are reported, both in the Beardmore district, a few miles west of the Little Long Lac gold camp. First was made by Conwest Exploration Co., 10 miles east of McKirdy, a point on the Long Lac-Port Arthur line of the CNR, with initial samples running better than 1% lithia, and with showings in evidence at

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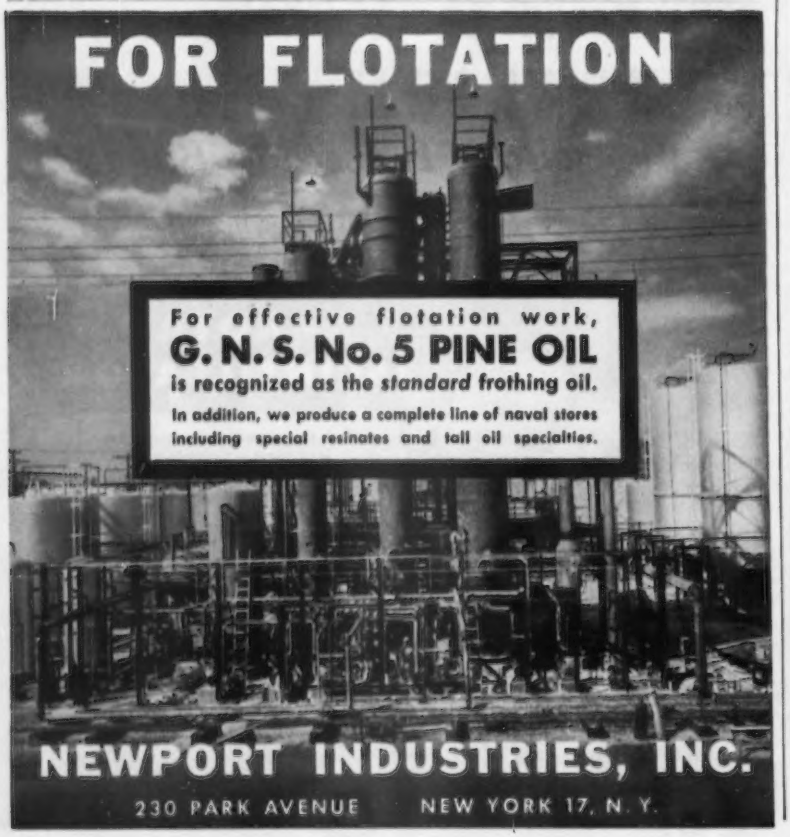

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Ontario *(Continued)*

various points along a three-mile length. Second, made when bush workers visiting the Conwest show recalled having seen similar material in the course of logging operations, is some 25 miles to the northwest. Limited work has shown a strong structure with an abundance of spodumene (lithia) crystallization. Ground has been acquired by Nama Creek Mines, an M. J. Boylen company that also has a good copper prospect in Manitouwadge, and has recently acquired the Independent copper property in Newfoundland.

Bancroft area is having another busy season, with many companies active. These include Homer Yellowknife Mines, engaged in surface exploration of its 1400-acre group northwest of Wilberforce: Nu-Cycle Uranium Mines with 300 acres in Glamorgan Twp., where diamond drilling was started just after break-up; Red Bark Mines, pursuing an aggressive exploration program on its group adjoining the Faraday property (developing underground), and considering plans for work on six other properties held in the area; Canadian All Metals Explorations, Ltd., drilling on eight claims in Monmouth Twp.; Goldhawk Porcupine, with two drills at work on a strong pegmatite dike that features its Faraday Twp. property; and Dyno Mines, busy at preliminary work for a 3-compartment shaft that will open three levels to a depth of 450 ft.

QUEBEC

Donalda Mines, gold producer of the Noranda district, will deepen its main operating shaft to 1975 ft from its present 1315-ft depth. Plans are to open new production levels at the 1725 and 1875-ft horizons to tap the orebody found in deep drilling last year.

New ore, which has changed the mine's outlook appreciably, shows a potential of 430,000 tons averaging 0.35 oz gold per ton. Shaft job is scheduled for completion before year-end.

Campbell Chibougamau Mines is now a copper producer, culminating a history of development that started back in 1936. (The operation was closed all through the war years.) Initial milling objective is 1700 tpd. Start of production was delayed to await the arrival of hydro power, but this enabled the company to keep mine development well ahead of minimum milling requirements.

West Macdonald Mines shipments of zinc-pyrite ore will be started by mid-summer to the enlarged mill of Waite Amulet Mines, where it will be treated on a custom basis. Both companies are controlled by Noranda Mines; 1,000 tpd will be shipped.

Eldrich Mines is making good progress in shaft sinking; the 3-compartment opening is well past half way toward its objective of 1,000 ft. Seven levels will be established to develop the 650,000 tons

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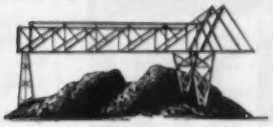
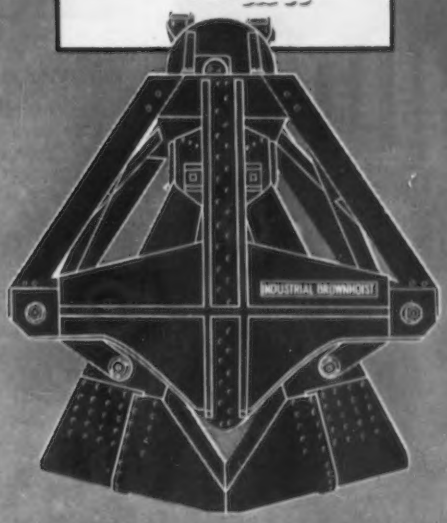
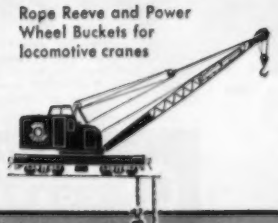




Rope Reeve and Power Wheel Buckets for locomotive cranes



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Quebec *(Continued)*

of ore averaging 0.2 oz gold per ton indicated by surface drilling. Property is in the Noranda area, and the company hopes to start production by shipping ore to the Noranda smelter, provided the silica content proves to be high enough to make it valuable for smelter use.

Lyndhurst Mining Co., developing its property in Destor Twp., north of Noranda, is into ore on its first level at 175 ft. First look suggests grade and dimensions at least as good as those indicated by drilling.

A start has been made on geological work by Tiara Mines on its new 800-acre lithium prospect in LaCorne Twp., Northwestern Quebec. Company is the former Roy Silver Mines, reorganized some months ago after closure of its silver-cobalt mine in Ontario's Gowganda area.

Electro Refractories and Abrasives Corp. and Strategic Materials Corp. will mine and process feldspar and mica in Bergeronnes Twp. and on the north shore of the Gulf of St. Lawrence, under a new company, Spar-Mica Corp. Ltd.

NEW BRUNSWICK

Three-compartment shaft at the New Larder property of Anacon Lead Mines is nearing the half-way mark on its way to 1500 ft. It will be driven to its objective without stop, after which levels will be established at 150-ft intervals. First lateral work will be done on the No. 2 zone, where drilling indicated 605,993 tons average 10% combined lead-zinc content.

New Brunswick Uranium Metals and Mining, Ltd., is resuming work on its 180-claim property near Harvey, 30 miles southwest of Fredericton. A large amount of radioactivity was encountered in preliminary exploration and further prospecting has been recommended.

First three crosscuts through the ore on the first level at the No. 12 (Anacon-Leadridge) orebody of Brunswick Mining & Smelting Corp. showed width in excess of 160 ft and grade in excess of 13% combined lead-zinc content. Development ore is being treated in the 150-ton test mill which started operating last winter, and reports to date indicate no serious metallurgical problems.

BRITISH COLUMBIA

Immediate $20,000 exploration and development program will be undertaken to bring Silbak Premier Mines Ltd. base metal property at Stewart back into commercial production.

Decision to revive the mine which has in its 37-year-history paid $27-million in dividends (highest of any B. C. mining operation except Consolidated

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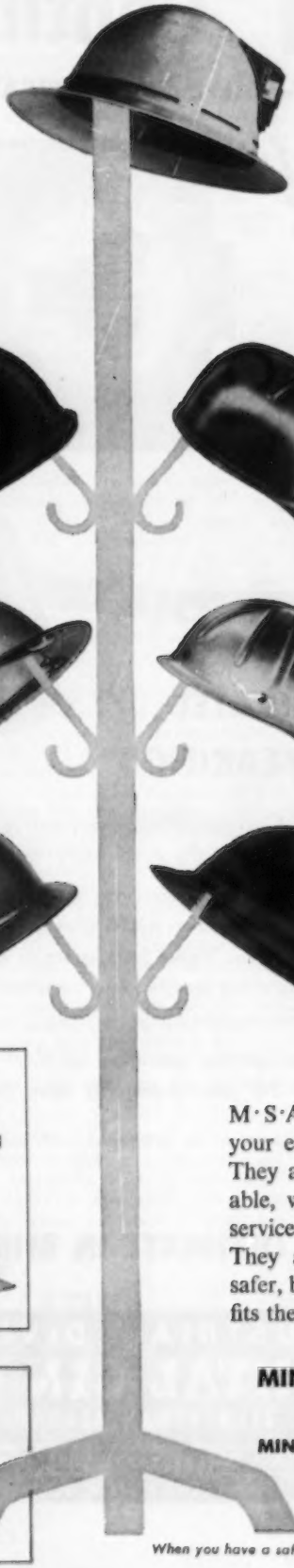

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TYPE T ALUMINUM CAP

This 9-ounce protector is die-stamped in one piece from tough aluminum alloy. Balanced for comfort, well-ventilated. Snap-in lining adjustable to any size.

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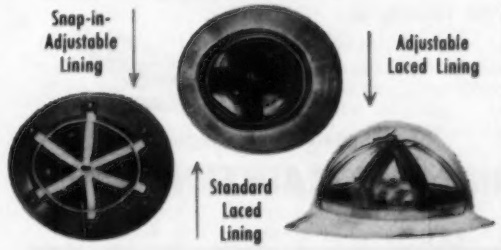

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British Columbia *(Continued)*

Mining), was made by new board of directors at annual meeting in Vancouver.

New program for the mine, which has produced $100-million worth of gold, silver, lead, zinc and cadmium, will involve "cutting expenses to the bone" according to Arthur Eric Bryant of London, representing Selukwe Gold Mining and Finance Co., which holds more than 1-million Silbak Premier Shares.

Bryant was named president, succeeding Cromwell Hockley of Selukwe, who has retired. New vice-president is B. H. Gunning, managing director of Giant Mascot base metal operation at Spillimacheen. Henry Hill of Vancouver has been retained as consulting engineer, the same position he holds with Giant Mascot.

Mill would be capable of handling about 200 tpd ore and company will be looking primarily for lead and zinc.

A. J. McClellan, president of 92 Jackson Basin Mining Co. reports selected uranium ore samples from the claims near Slocan have provided excellent assays, ranging from 0.20% U_3O_8 to 11.8%.

Company is undertaking a broad program to check and test the value of the claims, reported McClellan, and engineers have laid out base cross lines for a scintillometer survey.

The uranium property is being operated as a separate operation from the company's lead-zinc silver property at Kaslo, where development is continuing.

Whitcomb & Co., New York investment bankers, will spend more than a $1-million in the next year to develop properties of Nimkish Iron Mines Ltd., located 30 miles from Englewood on northeast corner of Vancouver Island.

More than 2-million tons of high grade ore have been blocked out by Nimkish, a subsidiary of International Oil & Metals Corp., the board chairman, W. Dale Bost, said, and the property is expected to contain 5-million tons of proven ore.

Wright Engineers Ltd. of Vancouver is designing a new plant, and drilling is being supervised by Al Upton and Dr. James Black of Vancouver.

SASKATCHEWAN

Gunnar Mines Ltd. in the Beaverlodge uranium area has opened a new mine which will be ready to begin production to meet the first scheduled shipment of ore next October.

President G. A. Labine said pit development is well advanced and no difficulty is anticipated in maintaining mill feed by the date of production.

New heavy drill equipment is being installed and will be in operation in the pit by late July. Originally it was intended to begin production from underground operations early in 1958. But in 1954 it was decided to start shaft sinking in 1955 and speed operations.

Continental Potash Corp.'s mine at Unity is to receive new capital totalling $17,500,000 to bring the operation into 1,000-tpd commercial production next year.

Continental Potash was formerly known as Western Potash Corp. Ltd.

Continental's president Frank S. Walters said in Vancouver that it will take 18 months to complete shaft sinking, buildings and to get into production.

F. H. McGraw & Co. will do all the engineering, construction and management connected with the project, expected to have initial gross income from production of approximately $8-million annually.

Construction is expected to start in July when shaft will be sunk another 2,200 ft to reach orebody at 3500-ft level.

According to Walters, $6.5-million will be used for underground work: $7-million for mill construction.

Production will eventually be raised to 4,000 tpd which will be used by chemical and fertilizer industries.

MANITOBA

Sherritt Gordon Mines Ltd. reports that the tonnage milled during the first quarter of this year amounted to 196,427 tons, approximately 10% over rated capacity of the plant. New ore intersection was made at the Lynn Lake property 1500 ft from nearest underground workings. A width of 19.5 ft returned assays of 1.72% nickel, 0.71% copper, and 0.145% cobalt.

Exploratory work is also being undertaken on newly acquired properties in the northern part of the Province. International Nickel Co. of Canada has agreed to take further shipments of Sherritt's nickel concentrates at the rate of 100 tpd till the end of August and then 125 tpd to Jan. 31, 1956. This will boost the total nickel output by 2,500,000 lb a month for a nine month period.

San Antonio Gold Mines Ltd. reports a net profit of $213,241 for the year 1954. Ore reserves are reported at 350,000 tons. Forty-Four Mines, which is controlled by San Antonio is now contributing 25 tpd ore to the San Antonio mill feed. As San Antonio orebodies rake onto the Forty-Four property at depth, all ore treated in the mill will eventually come from the subsidiary company.

Violamac Mines are drilling on a promising lithium prospect in the Maskwa Lake area. First drill hole, recently completed cut 14.0 ft assaying 2.25% Li_2O (lithium oxide). Lithium showing has been trenched for a length of 2,000 ft.

IN LATIN AMERICA

MEXICO

Compañia Minera Santa Rosalia is successfully reworking a copper mine in

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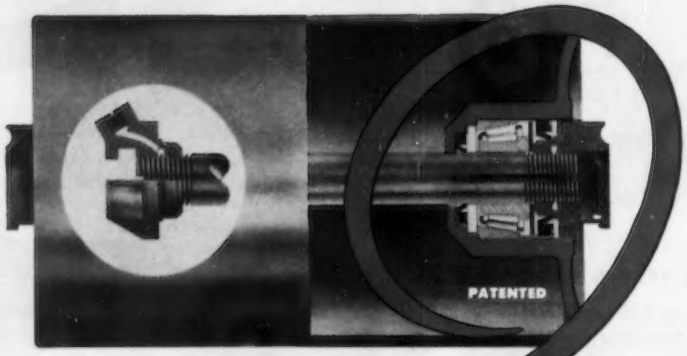

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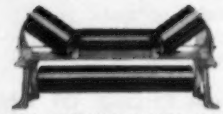

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Mexico *(Continued)*

Baja California. Mine had been worked by Compañia El Boleo for more than 50 years until the end of 1953 when El Boleo stopped operation, reportedly because of labor difficulties and low copper prices.

Santa Rosalia was organized by two men, Gaston Belanger and Ing. Garcia Quintanilla, backed by the government of Baja California and the Comisión Fomento Minera, a federal unit set up to aid small mines.

Since reopening the mine last September, Santa Rosalia has been taking out about 4,000 tons of copper ore per month. The ore is contained in chalcocite and is distributed in widespread seams found at depths varying from 230 to 420 ft. Some 300 workers are employed.

A smelter, located at the port of Santa Rosalia on the Gulf of California coast, turns out about 170 tons a month of blister copper. Blister is shipped to refineries in U. S.

Two manganese mines, which started production during World War II when Russia cut off imports to the U. S., are now busy turning out a combined production of 1500 tpm.

La Abundanza and Esperanza, both in Zacatecas, employ a total of 170 men. Ore is manganite and pyrolusite. It contains 44% manganese and 18% silica.

Both mines have timber-lined 150-ft vertical shafts. On the surface, ore is hand picked, then trucked to a railhead 21 miles away.

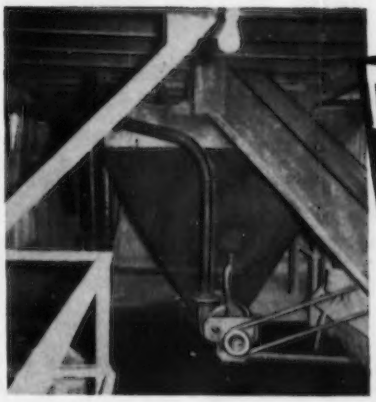
Last year the combined production of both mines amounted to 18,000 tons, of which 12,000 was exported to U. S. Most of the manganese used domestically is sent to the Teziutlan Copper Co. smelter in the state of Puebla, near Mexico City, where it is turned into ferromanganese.

Ing. Carlos Arellano is mine superintendent at both La Abundanza and Esperanza. Both mines are owned by Compañia Minera Central, S. A., of which Enrique Madero is president. Madero is a cousin of the former Mexican President Francisco I. Madero, who was killed in 1913.

CHILE

Aysen province is coming into preeminence as a possible mining province. Besides the several lead and zinc deposits being worked by the Aysen company, the Las Chivas massive copper deposit found by the Tamaya company, the du M' Zaita French interests are developing lead and zinc mines in this district; and what might turn out to be a large low grade copper-gold, lead-zinc mine has recently been acquired by some Chilean capital.

Development of the smaller high-grade iron deposits of Chile continues actively. There is a strong demand for 60-70% iron ores by the U. S. and Europe. In Coquimbo province the Infiernillo and El Dorado mines are actively being worked; others are being sampled and opened up around Vallenar; Cerro Imán to the



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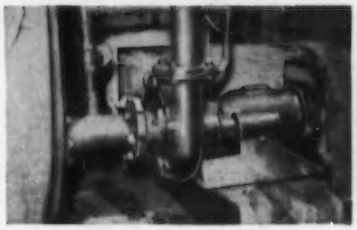

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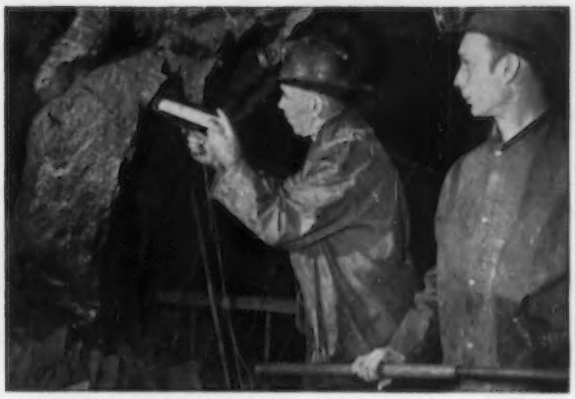

2, LOADING PRIMER into long hole. In this type work, use of MS Delay Electric Caps virtually eliminates cutoffs and greatly decreases overbreak. Damage to walls or ribs is minimized, as is dilution of the ore.

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Chile (*Continued*)

west of Copiapó and the Colorados near Chañaral are almost ready for open cast mining.

Deposits contain anywhere from 2- to 10-million tons of ore but all of them are very near the coast.

Among the large ones, El Tofo is nearing exhaustion, but Romeral with 20-million tons of reserves is ready for mining by Bethlehem Steel and the largest of them all, Algarrobo, located south of Vallenar is idle. This deposit, which may contain up to 100-million ore tons, belongs to a Dutch-German company.

Progress is being made in construction of a 35 tpd contract sulphuric acid plant at the port of Antofagasta. Chilean brimstone will be used as raw material. The machinery and technical know-how is being supplied by Lurgi from Frankfort and the plant is being built by Corporación de Fomento (Chilean RFC). Acid from this plant will supply a much needed lixiviant for some 30 small leaching plants in Antofagasta province where oxide copper ores are plentiful and can be mined at reasonable cost.

Foreign Exchange Control Commission, following negotiation, has granted Fundicion Nacional de Paipote, the government smelter, necessary funds for a new Babcock and Wilcox boiler and auxiliary equipment. (See *E&MJ*, May 1955, p 176).

Boiler is expected to be shipped out this month. Installation will include use of pre-heated secondary air at approximately 400 degrees and employment of pulverized coal to increase reverberatory output.

ARGENTINA

Argentine Mining Union in late May made a formal request to the Central Bank asking it to cease granting import licenses for magnetite, iron oxide, graphite, mica, asbestos, manganese, talc and other mineral substances. Union announced that the request was made on the grounds that these materials were not only available locally in quantities sufficient to meet domestic needs, but that further granting of imports is an unnecessary drain of foreign exchange.

In San Juan Province, National Lead Co. is making satisfactory progress with installation of lead mining facilities, including housing quarters, shops, etc., at Castaño Viejo, Calingasta. Scheduled to produce 6,000 tons annually of lead concentrates, Castaño Viejo is expected to handle 200 tpd crude ore and will call for an investment estimated at 60-million pesos and evenutally employ over 1,000 workers.

Argentina's numerous large and small mining enterprises will be under a single mining association, Federación Argentina de la Minería. This brings an end to years of bickering between the country's countless regional cooperatives, collective societies and so-called mining chambers, for prestige and leadership and government favoritism.

Federación, in turn, becomes another dependency of the fast growing and all-powerful General Economic Confederation, which already controls hundreds of industrial and commercial federations of comparatively recent formation.

IN ASIA

INDIA

India's iron ore reserves are estimated at 21,000-million tons—nearly one-quarter of known world reserves—according to a United Nations survey. World reserves are put at 84,580-million tons (against 53,918-million tons estimated four years ago).

Although possessing the world's largest reserves, India ranks seventh in a list of producing countries. In 1951, India produced 2,378,000 metric tons against U.S. production of 60,084,000 metric tons. Iron content in Indian ore is over 64.0%.

KOREA

McGraw-Hydrocarbon Inc., joint venture of F. H. McGraw & Co. and Hydrocarbon Research Inc. will design and construct a $25-million chemical fertilizer plant (with coal as the reported raw material) at Urea. Facility will produce 85,000 tons annually, about one-third of Korea's present agricultural needs.

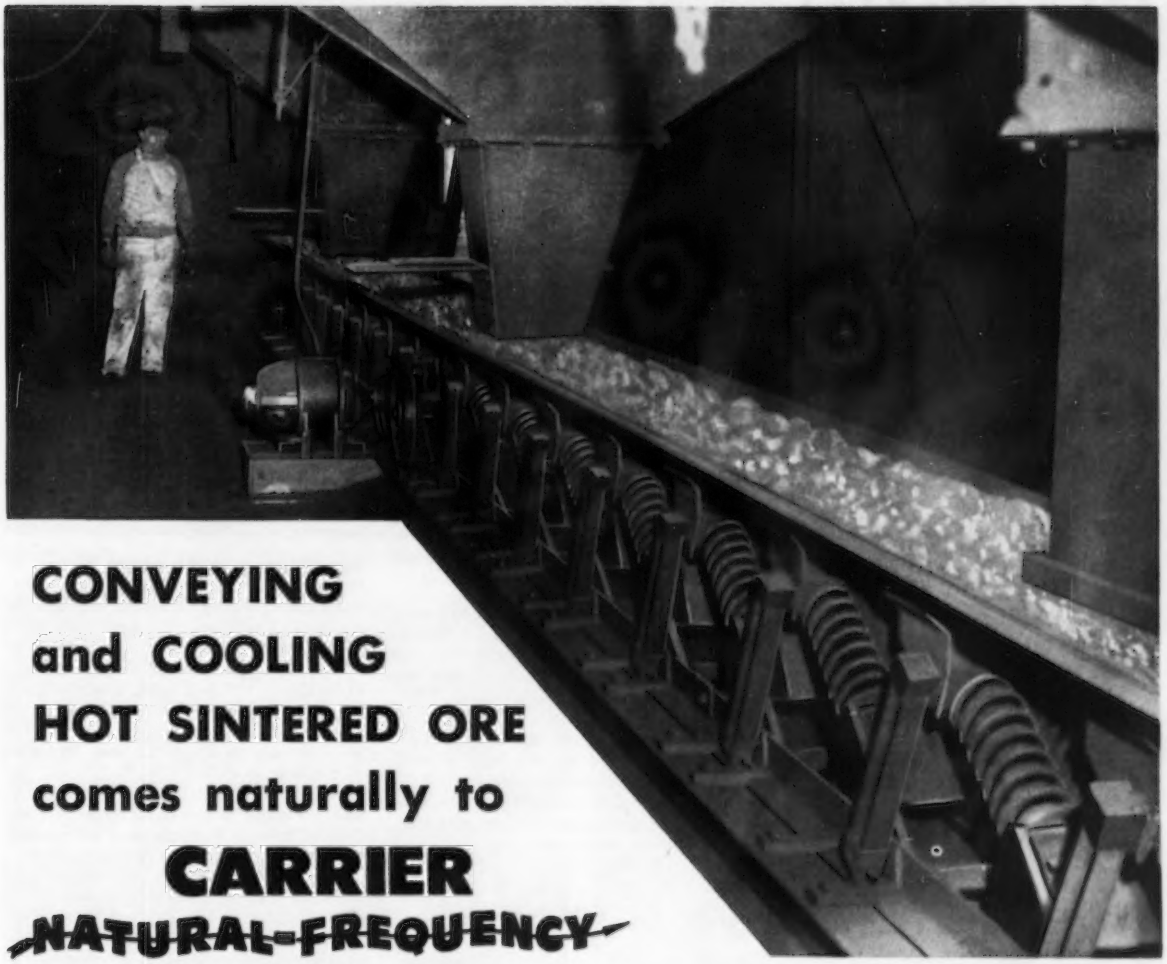
IN EUROPE

FINLAND

New prospecting method has been developed by Dr. Matti Salmi, state geologist. He calls it the peat-chemical ore-prospecting method.

Salmi started working on this method in 1950 when he found trace elements in peat samples. He discovered that copper, zinc and nickel findings in the peat were commoner in samples from swamps that lay close to primitive rock containing these elements. Particularly rich yields came from peat in the vicinity of the Otanmäki mines, where apart from iron the ore contains titanium and vanadium.

Salmi claims that it is possible to investigate deposits under swamp by fixing the exact position of these deposits by magnetic measurements and deep boring. He proved this in an investigation of ore lying 10-12 m under moraine gravel and sand with a top layer of ½-2 m of peat. Titanium and vanadium findings were richest in the peat right above the ore bed. Thus the method also helps to localize suspected ore deposits. Positive experience has also been gained with this method in Finland in the search for



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Carrier Natural-Frequency Conveyor in Alan Wood Steel Co. plant, Conshohocken, Pa.

Conveying and cooling up to 40 tons of hot sintered ore an hour is a "natural" for Carrier Natural-Frequency Conveyors. The 57-foot unit in Alan Wood Steel Company's Conshohocken plant, above, is powered by one 7½ H.P. drive and has a one-piece steel-plate pan, ½" thick. It receives the 700° (F.) ore from hoppers, then quickly vibrates it to storage with a gentle, abrasion-free motion. The conveying speed is 90′ per minute.

Notice that no water jackets are required for cooling—the conveyor's spring hangers have air-gap insulation spaces that not only cool the pan and ore, but also eliminate the possibility of corrosion and leakage!

And because of exclusive Natural-Frequency design, there's an absolute minimum of maintenance and down-time!

Hundreds of America's leading industrials are now using Natural-Frequency Conveyors and processing equipment for many hard-to-handle products — things like limestone, coke, mill scale and slag . . . cement clinker . . . castings . . . machine turnings . . . sand . . . minerals . . . plastics . . . bulk chemicals . . . food products. If *you* handle "tough" materials—anything hot, sharp, wet, abrasive, friable, brittle, stringy, jagged or oily—it will pay you to get the whole Natural-Frequency story. Mail the coupon, *today!*

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Finland *(Continued)*

molybdenum. What is more, this method was successful with molybdenum when other methods had failed.

ITALY

An Italian mining company announced that it has found a deposit of sulphur-bearing mineral, estimated at 26-million cu m, 50 km north of Rome.

It stated that the sulphur content of the ore varies from 20 to 40%.

CZECHOSLOVAKIA

Geological studies conducted since 1953 in the Pribram region are reported to have proved existence of uranium. Size of deposits there is estimated to permit 30-year operations. At the same time, private Western estimates state that the Joachimstal uranium deposits will be depleted completely within the next 8 years.

At the Pribram site, a team of Soviet experts, guarded by 150 Czech militia men, began operations during December 1954. With mining activities rapidly increasing, the number of workers has risen from 1954's 400 to 1,100 at present. Pribram deposits are estimated to be larger in over-all size than the Joachimstal (East-German/Czech) mines.

GERMANY

Establishment of an international federation for exchange of technical information on ore treatment has been proposed by M. Seyer, representative of the French Industry and Economics Ministry at the first international congress for ore preparation, held at Goslar.

About 600 scientists and ore mining experts from 20 countries attended the congress.

Spokesman for the congress said the main subject discussed was the problem of metal supplies. The fact that the present known metal ore deposits were expected to be exhausted within 30 to 50 years made it necessary constantly to improve ore processing methods, particularly the preparation processes for low-grade ores.

Search for uranium in Bavaria by Eisengewerkschaft Maximilianshuette has proved some small, but easily processed low grade deposits in the Fichtelgebirge hills. Firm will also seek manganese near Berchtesgaden.

SWEDEN

World's largest exporter of iron ore, Luossavaara-Kiirunavaara Lktiebolaget (LK AB), may be nationalized as of Sept. 30, 1957, according to authorization given by the Swedish Riksday May 25. *(E&MJ,* May 1955, p 183)

Technically the decision made this week does not nationalize the company. It only gives the state the right to nationalize it, and the state's decision must be made not later than Sept. 30, 1955, thus serving two years' notice on TGO, the operating company.

RUMANIA

Teliuc ore mine, the most important supplier of iron ore to the blast furnaces of Hunedoara and Calan, has been extensively mechanized during the past years. 100% of transport is fully mechanized; loading operations 50%.

Output of ore is nevertheless very slow. During the past year only 38.24% of locomotive capacity was utilized, and only 15.69% of the excavators. Reason for low utilization rate is the unrelieved scarcity of spare parts.

IN AUSTRALIA

Uranium Consolidated N. L. may form a new company to work two rutile areas at Lennox Head in New South Wales. An early start of operations and a treatment plant for the area are planned. Estimates claim a minimum of 19,750 tons of rutile with probable extensions in one area and close to 17,000 tons of proved rutile deposits in another area.

Torrington-Emmaville lease was abandoned as radioactivity was due only to thorium. Option has been taken over the Ortona copper mine and the company is fast becoming interested in copper mining in North Queensland.

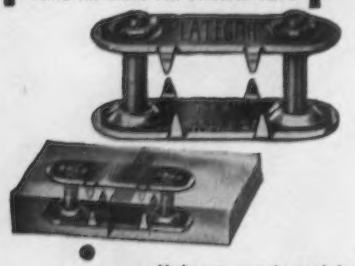
Drilling at the Morning Star mine of Mt. Magnet N.L. in Western Australia indicates about 60- to 100,000-tons of ore of about 10 dwt gold a ton. Mine will be pumped dry and an internal underlay shaft will be sunk to open up new levels at 500, 600 and 700 ft. Disclosed ore is expected to take up to three years to mine.

Airborne scintillometer surveys of large areas in Western Australia have been arranged by the Federal Bureau of Mineral Resources in cooperation with the Western Australian Dept. of Mines. Investigation by ground-based parties will follow in the area near Port Hedland and Marble Bar. Similar surveys will be made later on near Norseman and Meekatharra, also in Western Australia. Airborne surveys in the Katherine-Darwin area are being extended.

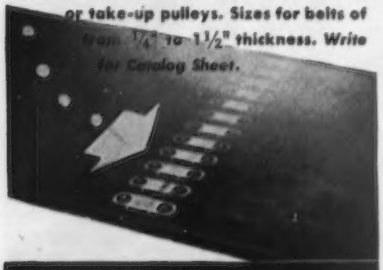
Evidence from No. 1 drill hole at the Mary Kathleen uranium field points to a new mineral species Concentrate on the mineral indicates that it is a borosilicate of cerium and lanthanum. Wide interest was created and further research was ordered.

Recent development at Hill 50 Gold Mine N.L., has raised the estimate of ore reserves below the 820 ft level from 400,000 tons to 550,000 tons of 13-dwt grade.

PLATEGRIP
PLATE FASTENERS FOR CONVEYOR BELTS



Make strong dust-tight, water-tight joints in belts of any width. Special design spreads tension uniformly across belt, allow natural troughing of belt and assures smooth operation over flat, crowned or take-up pulleys. Sizes for belts of from 1/4" to 1 1/2" thickness. Write for Catalog Sheet.



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A heavy duty money maker that will economically abrade and scrub ore, crushed stone or gravel . . . year after year.
Handles material up to 8" in diameter . . . capacity to 150 tons per hour (depending upon material size and amount of foreign matter to be removed). Tub is 9'4" wide x 24' or 30' long. Both logs are 48" dia. Sturdy Tubular log shaft . . . no deflection. Enclosed gearing at discharge end as shown.

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Australia *(Continued)*

Northern limit of the ore-shoot has been reached on both the 613-ft and 1060-ft levels. Values are following down a northerly pitch which has steepened to be almost the same as at the southern limit. Inclined hole is being drilled to crosscut the lode down the pitch to the 1300-ft horizon. Work has also begun near the main crosscut on a winze to the 1300-ft level, which will test the continuity of the high values in this area.

Promising development is reported from the Kimberleys area in Western Australia where three companies (Uranium Mines N.L., Northern Uranium Development N.L. and Western Uranium Mines N.L.) are jointly prospecting.

On the Denham lode, about 80 miles south of Wyndham, five trenches show 0.2% uranium oxide over a width of 20 ft in leached material. Uranium materials are also showing on the Kimberley lode and mineral claims totalling 1730 acres have been pegged. Further south, three showings of uranium were found and are being investigated.

Record 106,656 tons of ore went through the mill of Mt. Isa in March. Previous best was in October 1953. The greatest increase was in copper with the best yet figure of 54,705 tons. The heavy media plant is now running smoothly. One of the bigger plans now being carried out at the lead smelter is the evacuation of the hillside to hold the heavy media concentrate which is expected in increasing amounts now that the new plant is in operation.

NEW CALEDONIA

Rene Hoffherr, French High Commissioner in the Pacific, has given further details of plans for increasing nickel production in New Caledonia. He made his statement at Noumea before the General Council of New Caledonia.

According to Hoffherr, La Societe "Le Nickel" will undertake expansion and modernization of its installations at Doniambo at a cost of 3.5-billion francs ($10-million). Expansion is entirely dependent on provision of additional hydroelectric power now agreed upon by the French Government. Plans are being made for a five-fold increase of power from installations on the Yate River. The projected work, together with work now in progress, will ultimately produce 350-million kwh annually.

IN AFRICA

Harmony Gold Mine, OFS, has topped its own world tunnelling record by driving 1394 ft in 26 working days, 89 ft better than the figure set in December last year.

Tunnel was 5,000 ft underground with an average rock temperature of 104 degrees F. Work proceeded without a break except for loss of 20 hours—14 due to mechanical troubles and six for supporting bad hanging. Main improvement over methods used in December was use of 85 lb drifters instead of 58 lb and an increase in airleg size from 2 5/16 to 2 5/8 in. New drilling rate is 14 in. per minute. Cleaning techniques were modified by using two locos with an odd number of hoppers which meant that there was always one car behind the loader.

Very large and rich deposit of niobium and rare earths has been discovered north of the Kenya-Tanganyika Border. Drilling shows in the first 22 ft of depth 30-million tons of ore containing 3.1% total combined oxides of rare earths, including radioactive monazite, and 0.7% niobium oxide. Monazite reportedly contains at least 0.4% thorium. Kenya government has called for tenders for an exclusive license to prospect the area. In the course of normal geological mapping two other areas of high radioactivity have been noted not far from the northeastern shore of Lake Victoria.

Biggest survey in the mining history of Rhodesia is being undertaken by a company now being formed by Anglo American Corp. and the British ("Chartered") South Africa Co. It will cover 28,000 sq miles in Northern Rhodesia. Methods to be used include aerial geophysical surveys and chemical soil analyses. Rio Tinto is also engaged in investigating possible mineral deposits in the territory.

Internal borehole put down by Free State Geduld from a haulage level intersected the Basal reef horizon and obtained a value of 6,461 in.-dwts. Best value obtained in this area previously was 1,747 in.-dwts from a surface borehole. First development results in the President Brand No. 2 shaft gave 1,007 in.-dwts.

Plans are being prepared for the opening up of one of the more intriguing geological areas in the Free State goldfield; the Van den Heevers Rust ground controlled jointly by Anglo-Transvaal Cons. and General Mining. It is underlain by the Leader-Basal reef horizon which is exploited by other companies, but the values disclosed by drilling seem uneconomic. Above them is a long narrow strip—some 26,000 ft on strike by 1,000 ft on dip which has yielded values up to 2 to 3,000 in.-dwts over reef widths 5-6 ft.

A shaft will probably have to be sunk on the edge of the area, carefully avoiding locking up any ore in shaft pillars and a drive put into the zone of enrichment. Thereafter development will be on reef.

Magundi Copper Mines and Minerals has acquired "certain interests" in copper-bearing properties in Northern Rhodesia. Total discoveries so far amounted to about 158,000 tons of 4% ore, according to W. A. E. Winterton, chairman.

Sociedade Boliden de Mocambique, Lisbon, affiliate of Swedish Boliden Co. Ltd., will prospect for and exploit ore deposits in a 50,000 sq km area in the Mosamedes

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125,000 MILES and 3 recaps cut tire costs at Colonial Coal Corp.

PITTSHAW Trucking Co. trucks are equipped 98% with BFG tires.

THESE TIRES have seen 1200 hours' service at Eagle-Picher mine.

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THESE four mining companies—all in different parts of the country—have one thing in common: they're saving money through the outstandingly long service they get from B. F. Goodrich tires.

The Colonial Coal Co. in Kentucky reports 125,000 miles and 3 recaps from Universal tires. Clinchfield Coal Corp. in Virginia often got only 30 days' service from other makes of tires, reports B. F. Goodrich tires can be recapped. "BFG tires are better than any we've ever used," says Pittshaw Trucking Co., Pennsylvania coal hauler. And down in Oklahoma, the Mining & Smelting Division of Eagle-Picher Co. reports recaps give 75% of original mileage.

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You can get money-saving service like this, too, particularly with B. F. Goodrich *all-nylon* tires. Nylon is stronger than ordinary cord materials, withstands double the impact, and resists heat blowouts and flex breaks. The B. F. Goodrich *all-nylon* tire body outwears even its extra-thick tread, can still be recapped over and over!

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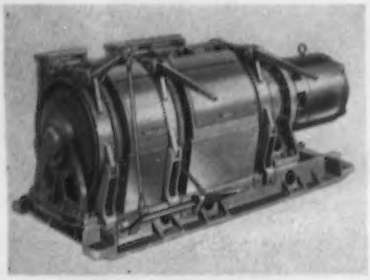

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Africa *(Continued)*

area of South Angola and the Beira district in central Mozambique. Agreement covers all metals with the exception of oil, coal, gas, uranium and uranium minerals.

First prospecting will reportedly be for copper. Under agreement signed with Portuguese authorities, prospecting may continue for a 5-year period.

One Swedish exploration group has started work at the site.

Shortage of adequate rail transport facilities is still hindering South Africa's export trade in manganese. Latest report of Associated Manganese states that extensive retrenchment of staff has had to be undertaken and working profit for 12 months dropped to £770,000 from £1,323,000 for the previous year.

IN THE PHILIPPINES

Surigao Consolidated has started exploration work in Bataugas on an indicated copper-barite deposit. Following a nine-month exploration period Surigao has agreed to develop any ore that may be discovered on a profit-sharing basis with the Pan-Philippines Corp.

Mindanao Mother Lode is continuing active work on its Zambales copper property from two locations. Mill erection will proceed as soon as equipment has been moved from Surigao to the new site. On its second property, about 4 km from the first, diamond drilling has disclosed some rich copper ore but the ground is badly broken.

In spite of a decline in the gold price on the open market, which fell to 96 pesos per ounce at the end of May, Benguet Consolidated declared a 10c per share dividend, totalling about $1.2-million. This marked a resumption of dividends after a lapse since December 1952.

Philippine Embassy at Washington has advised that Philippine chromium, manganese and copper will be included in the stockpiling program of the U.S. Somewhat along the same lines is the report that 65,000 tons of chrome concentrates would be exchanged on a barter basis for U.S. agricultural products.

Republic of the Philippines Bureau of Mines exploration in cooperation with the Foreign Operations Administration has proven existence of more than 6-million tons of lateritic material containing 1.8% nickel. Other occurrences of the laterites are being investigated.

Nickeliferous laterites of comparable grade are now being exploited in New Caledonia, Cuba, and southwestern Oregon. Experiments were conducted on selective smelting of the Philippine ore by the Bureau of Mines at Albany, Ore. Using bagasse (sugar cane residue) for a reductant, ferronickel was successfully produced in electric furnace operations.

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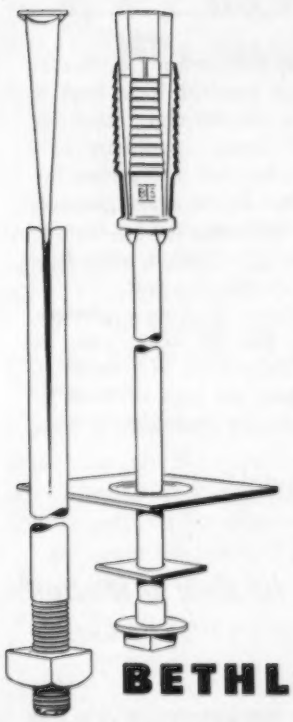

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Three sizes: A ¾ in. carbon-steel bolt, and a ⅝ in. high-strength bolt, each with typical breaking load of 24,000 lb; also a ⅞ in. high-strength bolt, having a typical breaking load of 45,000 lb.

Bethlehem also makes a hardened washer for use with these bolts. It reduces the friction between the bolt head and the roof plate that occurs when high tension in the bolt produces excessive bearing pressure. The washer permits the free use of impact wrenches, without galling or tearing of metal.

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A 1-in. bolt, with a centered, forged slot. No metal is removed in slotting. Opposite end of bolt has 5 in. of rolled threads. Bolt is for use with steel wedge, in 1¼ in. hole. When bolt is driven, wedge is forced deep into slot, expanding the bolt-end. Truncated-cone point prevents damage to threads. Usually comes with American Standard regular square nut.

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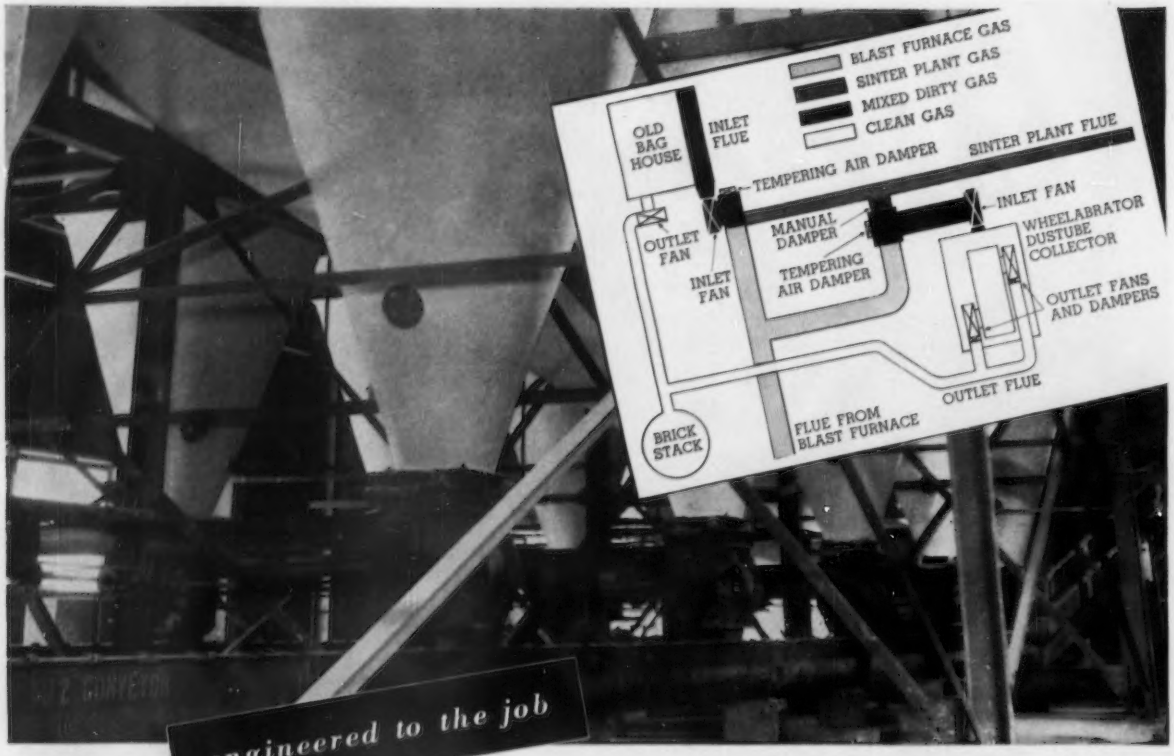

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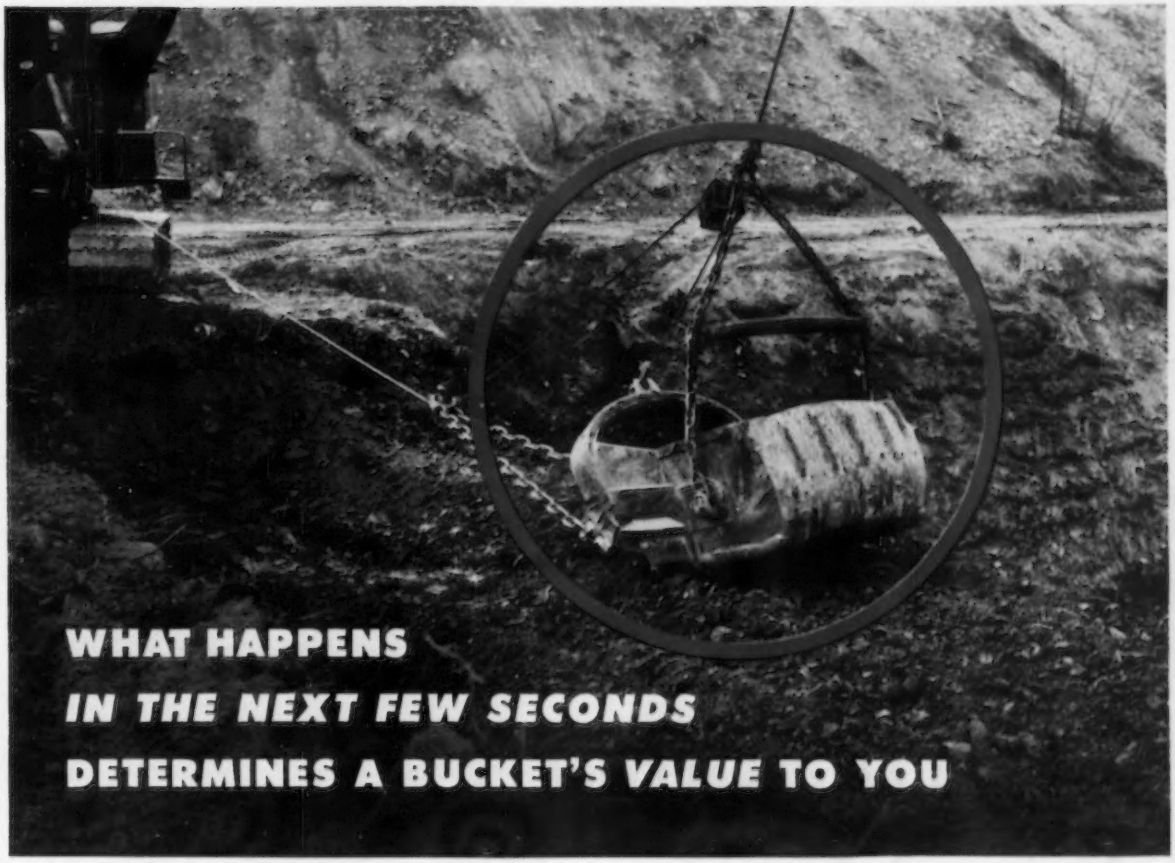

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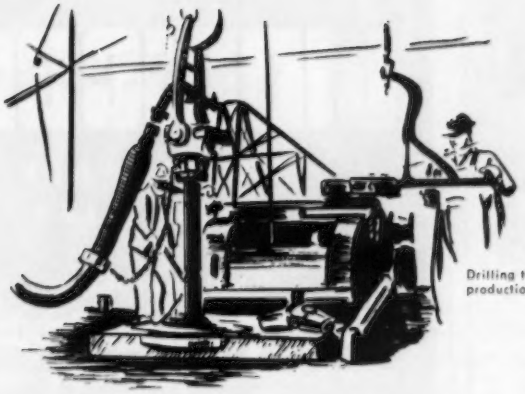

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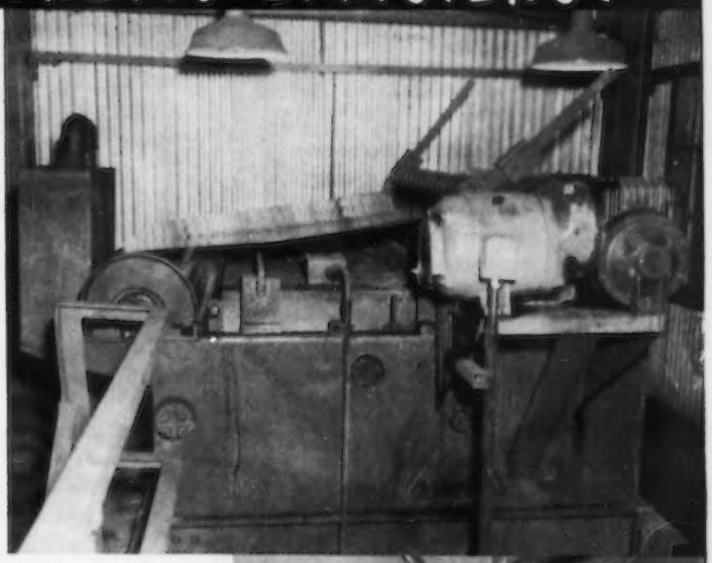

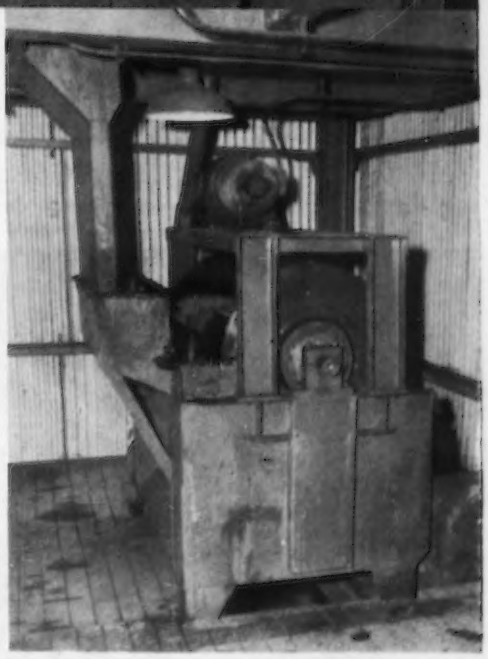

THE efficient pair of Dings Heavy Media Magnetic Separators shown here is turning out a record over-all media recovery of 99.855 per cent in a large standard heavy media plant treating Alabama coal.

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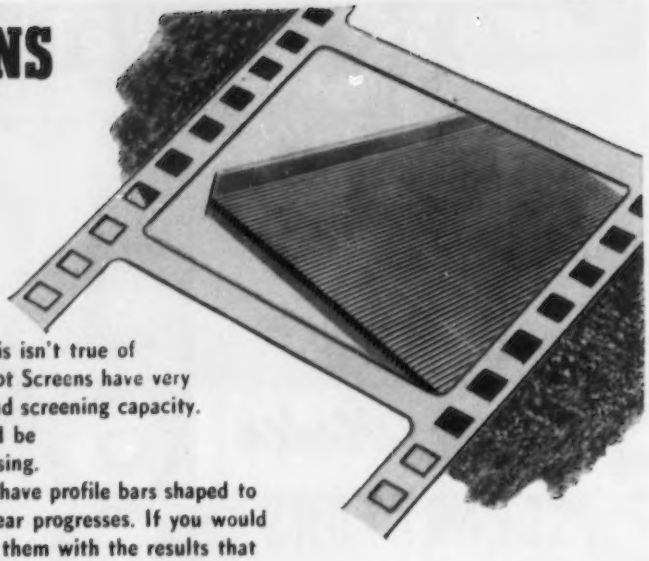

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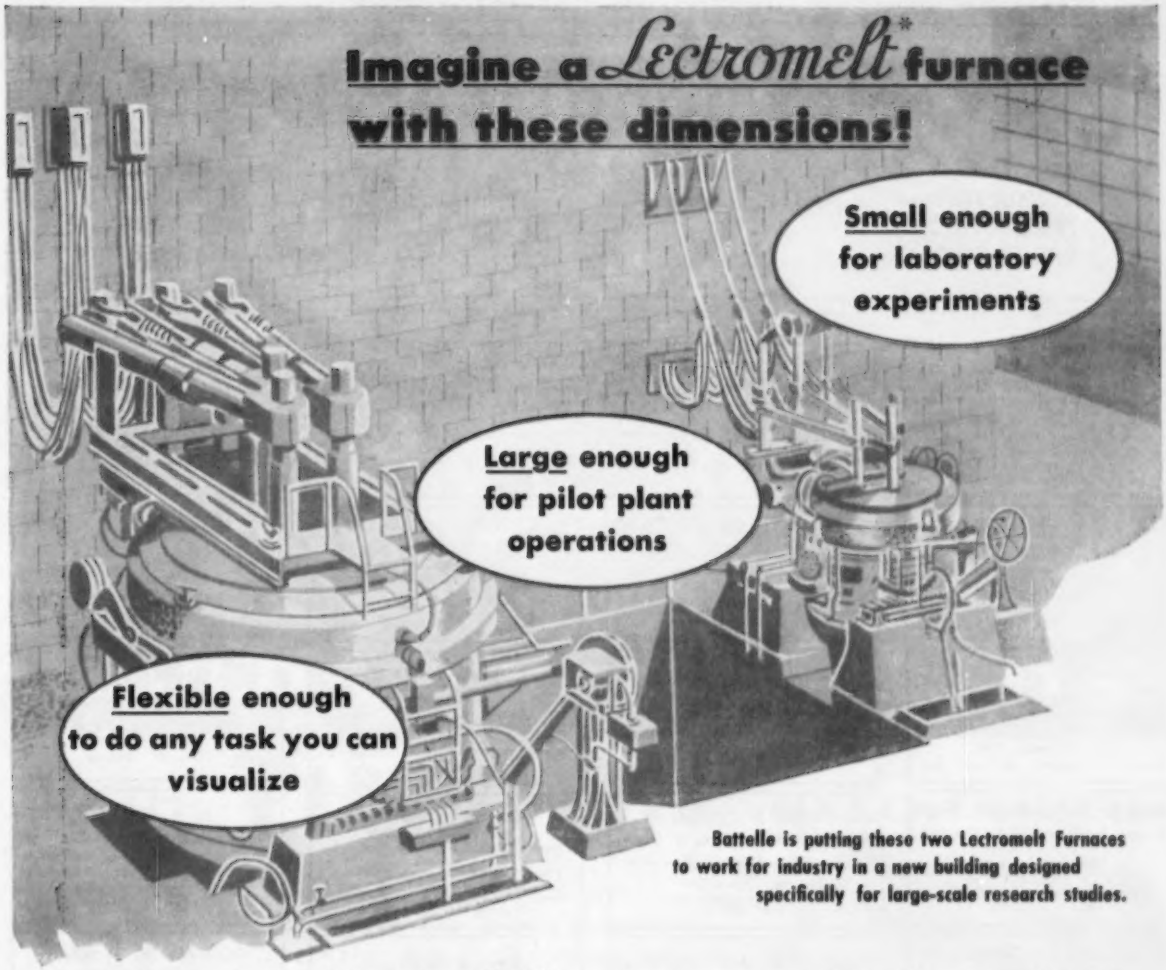
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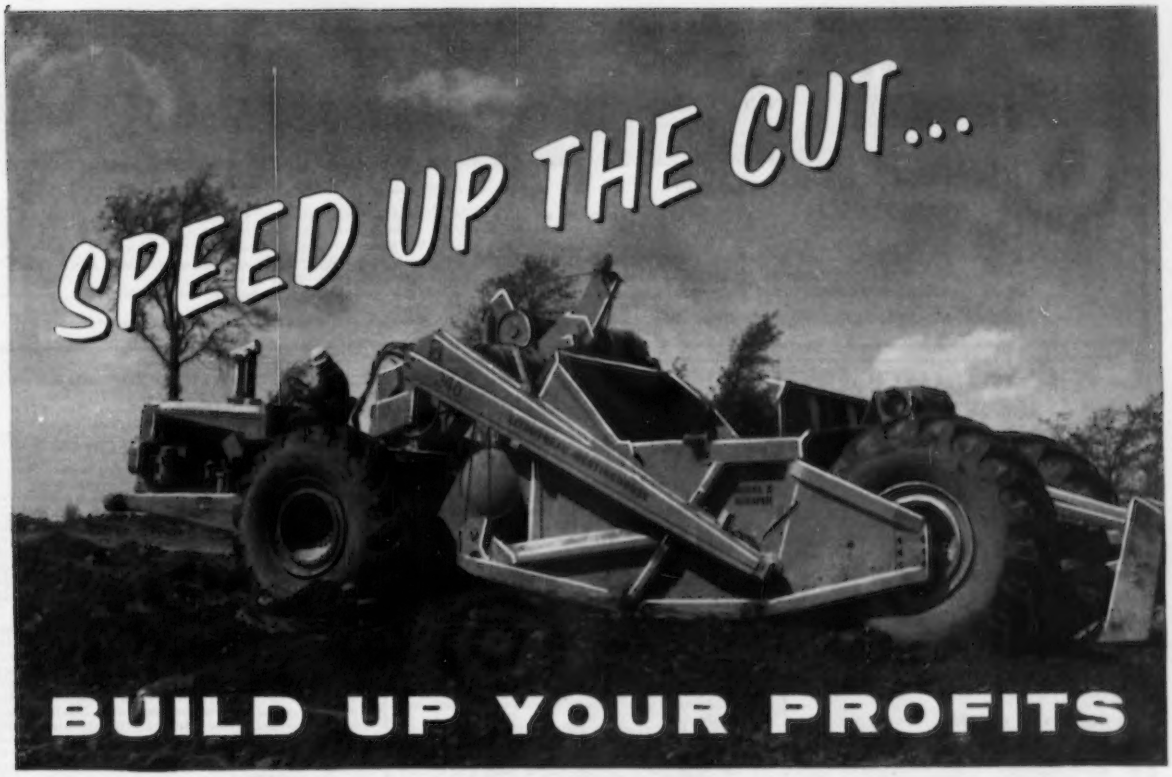

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MINE AND MILL MACHINERY

LARGE BLOWERS

4—GE 22,700 cfm at 5.75 lbs. pressure, centrifugal type.
1—IR Turbo Compressor 60,000 cfm at 5 lbs. pressure with 1735 H.P. Electric Motor.

COMPRESSORS

1—500 cfm GD Diesel Skid Mtd. w/D13000 Cat Engine—Like New.
1—420 cfm, same as above.
1—2695 cfm I.R. Model PRE-2 w/435 H.P. Synch Motor.

DRILL BITS, NEW

96,000—Portland Throwaways.
116,000—Liddicoats, 2H & 2L.
10,000—IR Type 1 & 2.
(Write for bargain prices & complete list of sizes.)

CRUSHERS, JAW

28 x 36 Traylor Sectional Frame.
10 x 30 Pacific.
9 x 36 Cedar Rapids.
9 x 16 Eimco.

CLASSIFIERS, RAKE

5—Dorr DSFH 4' x 21'8" Duplex.
1—Dorr DSFH 6' x 26'8" Duplex.
1—Denver 8' x 26' Duplex.
4—Dorr DSD 6' x 23'6".
1—Denver 15" x 13' Simplex.

CLASSIFIERS, BOWL

2—Dorr DSFB 6' x 26'8" x 12' Bowl.

CLASSIFIERS, SPIRAL

1—Hirsch 4' x 18' Double Pitch.
1—Akins 24" x 10' Double Pitch.
1—Wemco 36" x 15' Single Pitch.

DIESEL GENERATOR SETS

1—300 KW 480V, 3ph, 60 cycle with GM 8-268A Engine.
1—250 KW 480V—W/GM 8-268A Engine.
2—112½ KVA 220/440V D17000 Cat Engines Radiator Cooled.
1—75 KW GE 480V W/D13000 Cat Engine.
4—50 KW 220V 3 ph., 60 cycle with International UD18 Engine.

FLOTATION CELLS

2—Denver 6 cell #15 Rubber Parts.
1—Denver 6 cell #21 Rubber Parts.
5—Fagergren #9-S Rubber Parts.
1—Denver 6 cell #24 Rubber Parts.
1—Denver 4 cell #24 Rubber Parts.
1—Denver 2 cell #24 Rubber Parts.
1—Denver 2 cell #18 Rubber Parts.
1—Denver 3 cell #18 Rubber Parts.

FILTERS

1—4' 1-leaf Eimco.
1—3' x 4' Oliver Drum.
1—6' 2-leaf Eimco.
1—4' 2-leaf Eimco.

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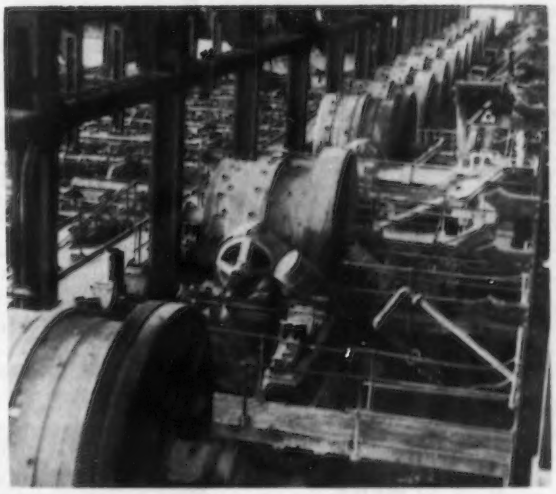
1—16" x 24" Denver Duplex.
1—12" x 18" Denver Duplex.
1—12" x 12" Pan American Duplex.



86 MARCY BALL MILLS

LOCOMOTIVES

6—Mancha Titan A Battery 18" ga.
1—GE 2 ton 18" ga. Battery.

BALL & ROD MILLS

24—Marcy 86 Ball (8' x 6')
4—Marcy 96 Ball (9' x 6').
1—8 x 36 Hardinge Ball.
1—7 x 36 Hardinge.
1—6' x 6' Hendy.
1—6' x 22" Hardinge.
1—6' x 16" Hardinge.
2—5' x 14' Allis Chalmers Ball.
4—5' x 14' Marcy Ball.
5—5' x 10' Allis Chalmers Rod.
1—4 x 5 C.I.W. Ball.
2—30" x 54" Denver Rod.
2—5 x 6 Allis Chalmers Ball.

SLUSHER HOISTS

3—25NNN-3D IR 3-drum Electric.
1—8-311 Sullivan 3-drum Electric 25 HP.
2—20 NM-2D IR 20 HP 2-drum Elect.

THICKENERS

4—80' x 10' Dorr with steel tanks.
3—60' x 10' Dorr with steel tanks.

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PHONE 3-3973

MAGNETIC SEPARATORS: 4—Dings type K, 3 roll and 4—type IR, 5 roll, with or without 3 phase, 60 cycle, 440 volt, M.G. set.

DRYERS & KILNS: 1—7' x 60', 1—7' x 65' and 1—5' x 30', single shell. 1—10' x 110' Link Belt #608 Multi-Louvre Dryer and Cooler.

BALL MILL: One 10½ x 25 ft., 450 H.P., 40 ton charge. Available December 1st.

FEEDER: Heavy duty Oro Feeder 60" x 15 ft. NEW condition.

CONVEYOR BELT: 1134 ft. 24", 32 oz. duck, 5 ply, ⅛" top, 1/16" bottom cover, in two pieces, on original reel, NEW, UNUSED.

COMPRESSORS: 1—Chicago Pneumatic 23 x 13 x 18, 625 H.P., one 19 x 11 x 12, 185 H.P., type OCE, 440 volt. One Ingersoll Rand 29 x 18 x 21, 478 H.P. and one 23 x 14 x 16, 300 H.P., type PRE, 2300 volts. All complete with auxiliary equipment.

JAW CRUSHERS: Allis Chalmers 18 x 30", sectionalized for underground use, V-belt, 50 H.P., 220/440 volt motor, new condition. Also, 48 x 60, 42 x 40 and 36 x 48", with or without motors and drives. Other sizes from 4" x 6" to 48" x 60".

SCREEN: Tyler Hummer type V-50, 4' x 5', double deck, fully enclosed, with Thermionic power converter. Guaranteed condition.

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LOCOMOTIVE CRANE: 25 ton capacity, standard gauge, gasoline powered, cast steel trucks, air brakes, with or without 1¼ yd. Williams clam shell bucket, thoroughly modern, excellent condition. Located Minnesota. For sale or rent.

LOCOMOTIVES: 2—65 ton diesel electric, standard gauge, thoroughly modern, excellent condition. For sale or rent.

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MINE HOISTS: Single and double drum 100 to 1500 H.P., with all electrical equipment. Complete specifications, drawings and photos available.

HOIST MOTORS:
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400 H.P., 588 RPM. 1200 H.P., 444 RPM.
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54 x 24, 42 x 16, 36 x 16 & 30 x 10

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1—48x60, 1—42x40, 1—30x42, 2—24x36.

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900 FT. 42 IN. LINK BELT COMPLETE CONVEYOR. COST $47,000 PRICE $18,800.

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10'x48", 8'x48", 8'x22', 6'x22', 6'x30", 5'x30", 3'x7', 4'x5', 4'x7', 4'x14', 5'x10', 5'x14', 5'x18', 6'x7', 6'x8', 6'x9', 6'x10', 7'x5', 7'x6', 7'x7', 8'x12', 8'x6' & 2—30" x 54 Rod Mills.

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6 DEISTER TABLES — ELECTRIC
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Hokitika, New Zealand

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1—2-2½ ton Whitcomb, 24" gauge
1—2½ ton Jeffrey, 36" gauge
2—3½ ton Mancha, 18"-32" gauge; with 2 sets Edison batteries
1—3½ ton Atlas, 24" gauge
1—4 ton Westinghouse, 24" gauge
1—4 ton Ironton, 36" gauge
2—6 ton General Electric
1—6 ton Mancha Trackmaster, 24" gauge, with 2 sets Gould KMZ-21 batteries
2—7 ton General Electric, 36" gauge, permissible
1—7 ton Atlas, 36"-48" gauge
2—8 ton General Electric, 36" gauge
2—8 ton Goodman, 36" gauge
3—8 ton Ironton, 24"-48" gauge
4—10 ton Atlas, 36" gauge

TROLLEY LOCOMOTIVES

1—½ ton Goodman, 36" gauge
1—5 ton Jeffrey, 36" gauge
2—5 ton Jeffrey, 42" gauge
1—6 ton Goodman, 36" gauge
1—6 ton Goodman, 42" gauge
2—8 ton Goodman, 42" gauge
3—10 ton Jeffrey, 42" gauge
1—13 ton Goodman, 42" gauge
1—13 ton Jeffrey, 42" gauge
3—15 ton Jeffrey, 42" gauge

FILTERS

2—2' x 4' Morse drum filters
2—4' x 8' Elmco drum filter
1—6' x 2' disc Oliver leaf filter
1—6' x 3' disc American leaf filter
1—18" Morse round pattern filter press
1—36" Merrill triangular filter press
1—#12 Sweetland filter press

DIAPHRAGM PUMPS

3—2" New Morse diaphragm pumps
2—2" Morse diaphragm pumps
1—4" Barnes diaphragm pump
2—4" Butchart diaphragm pumps
1—4" Dorrco pressure diaphragm pump

HOISTS

1—10 HP Vulcan #0 Single Drum
1—115 HP Morse New Single Drum
1—20 HP H&B Single Drum
1—22 HP Vulcan Single Drum #1½
1—30 HP Vulcan Double Drum
1—30 HP Vulcan Single Drum
1—37 HP Single Drum
2—52 HP Vulcan #4½ Single Drum
1—50 HP Fairbanks-Morse Single Drum
1—60 HP Vulcan #23ELF Single Drum
4—100 HP Box Single Drum
1—112 HP Vulcan Single Drum
2—150 HP Vulcan Single Drum
1—375 HP Dillon-Box Single Drum
1—22 HP Vulcan #1½ Double Drum
1—60 HP Ottumwa Double Drum
1—150 HP Dewco Double Drum Heist
1—40 HP American 3 Drum
1—80 HP Thomas 3 Drum
1—80 HP Lidgerwood
1—80 HP Clyde 3 Drum

CRUSHERS

4—2¼" x 3½" New Morse Lab Jaw Crushers
4—4" x 6" New Morse Lab Jaw Crushers
1—9" x 15" Wheeling Jaw Crusher
1—9" x 15" Farrell Jaw Crusher
1—8" x 24" Rogers Jaw Crusher
1—11" x 18" Universal Jaw Crusher
1—24" x 13" Farrell Jaw Crusher
1—10" x 16" Hercules Jaw Crusher
1—26" x 18" Williams Hammermill

MUCKING MACHINES

2—Elmco model 21 loaders
1—Conway model 60 loader
1—Gardner-Denver model 9 loader

CLASSIFIERS

1—2' x 15' Derr simplex rake classifier
1—4' x 18' Akins simplex spiral classifier

COMPRESSORS

1—44 CFM Ingersoll-Rand
2—88 CFM Ingersoll-Rand
1—179 CFM Ingersoll-Rand
1—360 CFM Gardner-Denver, model WBH, with 75 HP motor
1—447 CFM Ingersoll-Rand
1—637 CFM Sullivan
1—698 CFM Union
1—800 CFM Ingersoll-Rand
1—840 CFM Laidlow
1—1418 CFM Ingersoll-Rand

PORTABLE COMPRESSORS

1—105 CFM Ingersoll-Rand, gas engine driven
1—105 CFM Worthington, gas engine driven
1—210 CFM Worthington, continental gas engine
1—230 CFM Gardner-Denver stationary, Buda gas engine
1—310 CFM Sullivan, Buda gas engine
1—310 CFM Gardner-Denver stationary, Buda gas engine

BALL AND ROD MILLS

1—4' x 3' Marcy Ball Mill
1—4' x 4' Marcy Ball Mill
1—5' x 4' Morse Ball Mill
1—6' x 48" Hardinge Conical Ball Mill
1—8' x 22" Hardinge Conical Pebble Mill
1—3' x 8' Marcy Rod Mill

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1—FM-2 Ingersoll-Rand wagon drill

CRUSHING ROLLS

1—20" x 12" McFarlane-Eggers crushing rolls

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16# to 100# rail in stock

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WANTED
SLUSHER HOISTS

4—Ingersoll Rand or Joy 50 H.P. double or triple drum Slusher Hoists, 220/440 volt.

A. J. O'NEILL
Lansdowne, Pa.

EQUIPMENT AT ATTRACTIVE PRICES

MINE HOISTS:
1—850 HP Nordberg Single Drum, 3/60/2300, 1350 FPM, 3600 ft.—1⅝" Rope Drum Capacity.
1—400 HP Coeur d'Alene Double Drum, 3/60/2300, 1000 FPM, 3000 ft.—1" Rope Drum Capacity.
1—150 HP Coeur d'Alene Single Drum, 3/60/2300, 875 FPM, 2800 ft.—⅞" Rope Drum Capacity.

HEADFRAME:
1—124 Ft. Steel (H-Beam Const.) with 2—12' dia. x 1⅝" Rope and 1—12' dia. x 1⅜" Rope Headsheaves.

COMPRESSORS:
1—2200 CFM Chicago Pneumatic OCE with 350 HP, 3/60/440 Synchronous Motor.
1—2000 CFM Ingersoll-Rand PRE-2 with 270 HP, 3/60/440 Synchronous Motor.

CRUSHERS:
1—10 x 20 Traylor Jaw, Blake Type.
1—20x20 Cedar Rapids (New Holland) Impact.
2—Traylor Type T-6 Finishing (Gyratory Type).
1—24" x 20" Jeffrey Corrugated Crushing Rolls.

BALL MILLS:
3—8' x 36" Conical, with 150 HP, 3/60/2300 Slip Ring Motors.
1—8' x 26" Conical, with 125 HP, 3/60/2300 Synchronous Motors.
1—7' x 36" Conical, with 100 HP, 3/60/440 Slip Ring Motor.
1—6' x 22" Conical.
1—5' x 5' Marcy, with 75 HP, 3/60/440 Slip Ring Motor.
1—5' x 4' Colorado Iron Works, new Alloy Liners.

FILTERS:
1—8' x 10' Oliver Drum, with Oscillating Agitator.
1—8' x 6' Portland Drum, with Oscillating Agitator.
1—6' x 4' Oliver Drum.

PUMPS:
1—75 HP Pomona Deep-Well Turbine, 3/60/2200, 300 GPM @ 680' head, 650 ft. setting.
1—2" A-Frame Hydroseal Sand.
1—50 HP Worthington 2UBI Centrifugal, 3/60/440, 220 GPM @ 500' head.

MAGNETIC SEPARATORS:
3—Dings-Wetherill Type (modified) Cross Belt, 6 Pole, 18" Belt, 2½" take off belts.

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Box 1496 **Phone 9-2309**
Missoula, Montana

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2—New 6½' x 150' Kilns
1—#6 Williams hammer Mill
1—New Traylor 5'-6" T.Y. Gyratory Crusher
1—125 HP—3/60/440V—450 RPM Squirrel Cage Motor
1—Complete Lime Hydrating Plant
1—Complete Plant consisting of 4½'x40' Kiln, 3'x30' Cooler, Supporting Steel Framework, Motors, Fans, Dust Collectors, etc.

KILNS
1—4' x 40', 7' x 120', 8' x 125', 8' x 150' Kilns

DRYERS
4½' x 30', 5½' x 40', 6' x 40', 6' x 60', 8' x 70', 8' x 123'

CRUSHERS
1—48"x60", 42"x48", 40"x42", 36"x42", 30"x36", 24"x36", 18"x36", 12"x24" Jaw Crushers
2—42" x 16" Allis-Chalmers Crushing Rolls
1—36" x 16" Sturtevant Crushing Rolls
2—24" x 14" Rogers Iron Works Rolls
1—24" x 12" Farrell Bacon Crushing Rolls
1—No. 222, 322 Allis-Chalmers Type "R" Hydrocone Crushers
1—6", 10", 14", 16" and 20" McCully Superior Gyratory Crushers
36"—20" Traylor T.Y. Gyratory Crushers
No. 3 up to No. 12 Gyratory Crushers

BALL, ROD & TUBE MILLS
1—7' x 8', 6' x 12', 5½' x 10', 8' x 6' Ball Mills
2—5' x 16'; 1—5½' x 10'; 6' x 12' Rod Mills
2—5½' x 20' Tube Mills
2—6' x 22' Combel Mills—6' x 22' Tube Mills
1—10' x 48", 8' x 48", 5' x 22" Hardinge Mills
3—3-Roll Bradley Hercules Mills, Direct Connected to 300 HP Motors

MISCELLANEOUS
1—6', 14' and 16' Air Separators
1—6' x 4', 6' x 8' & 12' x 10' Oliver Filters

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Have you any machinery that you want to sell?

ALPHABETICAL INDEX TO ADVERTISERS

(This index is published as a convenience to the reader. Every care is taken to make it accurate, but E&MJ assumes no responsibility for errors or omissions.)

Acker Drill Co., Inc. ... 166
Aero Service Corp. ... 52
Allen-Sherman-Hoff Pump Co. ... Second Cover
Allis-Chalmers Mfg. Co. (General Machinery) ... 19, 41, 58
Allis-Chalmers (Tractor Div.) ... 12, 13
American Cyanamid Co. ... Insert between pp. 50–51
American Forge Co. ... 40
American Manganese Steel Div. American Brake Shoe Co. ... 54, 126, 127
American Steel & Wire Div. ... 129
American Wheelabrator & Equipment Corp. ... 182
Anaconda Wire & Cable Co. ... 117
Armour Chemical Div. Armour & Co. ... 143
Armstrong-Bray & Co. ... 178
Athey Products Corp. ... 184
Atlas Car & Mfg. Co. ... 161
Atlas Diesel AB ... 16, 17

Baldwin-Lima-Hamilton Corp. (Construction Equip. Div.) ... 51
Baldwin-Lima-Hamilton Corp. (Eddystone Car Div.) ... 30, 31
Barber-Greene Co. ... 174
Bemis Bro. Bag Co. ... 161
Bethlehem Steel Co. ... 18, 22, 181
Birdsboro Steel Fdry. & Mach. Co. ... 155
Bixby Zimmer Engrg. Co. ... 171
Booth Co., Inc. ... 152
Brunner & Lay, Inc. ... 173
Bucyrus-Erie Co. ... 42
Buell Engrg. Co. ... 136
Builders-Providence, Inc., Div. of B-I-F Industries, Inc. ... 39

Carrier Conveyor Corp. ... 177
Caterpillar Tractor Co. ... 112, 113, 118, 119, 202
Chicago Pneumatic Tool Co. ... 58B
Christian Engrs., J. D. ... 186
Clark Equipment Co. ... 139
Cleveland Rock Drill Div. ... 164
Colorado Fuel & Iron Corp. ... 38
Columbia-Geneva Steel Div. ... 27, 129
Continental Gin Co. ... 170
Coppus Engrg. Corp. ... 149
Crane Co. ... 20
Crucible Steel Co. of America ... 34
Cummins Engine Co., Inc. ... 62, 63

Denver Equipment Co. ... 14
Detectron Corp. ... 168
Diamond Tool Research Co. Inc. ... 152
Dings Magnetic Separator Co. ... 191
Dorr-Oliver, Inc. ... 8, 9
Dow Chemical Co. ... 28, 133
duPont de Nemours & Co., Inc. (Explosives Dept.) ... 175
Duria-Werk Karl Kempf, K. G. ... 186

Eagle Iron Works ... 178
Eimco Corp. ... Insert between pp. 18–19
Engineers Syndicate, Ltd. ... 176
Ensign-Bickford Co. ... 43
Euclid Div. General Motors Corp. ... 159
Exide Industrial Div. Electric Storage Battery Co. ... 151

Falk Corp. ... 56, 57
Firestone Tire & Rubber Co. ... 195
Frazier Davis Construction Co. ... 165

Galigher Co. ... 26
Gardner-Denver Co. ... 46
Gates Rubber Co. ... 130
General Cable Corp. ... 153
Georgia Iron Works Co. ... 142
Goodrich Co., B. F. ... 5
Goodrich Co., B. F. (Tire & Equip. Div.) ... 179
Goodyear Tire & Rubber Co. ... 50
Greensburg Machine Co. ... 156
Gustin Bacon Mfg. Co. ... 132

Hardinge Co., Inc. ... 150
Harnischfeger Corp. ... Third Cover
Hendrick Mfg. Co. ... 192
Hoffman Laboratories, Inc. ... 158

Industrial Brownhoist Corp. ... 167
Ingersoll-Rand Co. ... 3
International Harvester Co. ... 137
International Harvester Co. (Drott Mfg. Corp.) ... 21
International Nickel Co., Inc. ... 64

Jarrell-Ash Co. ... 190
Jeffrey Mfg. Co. ... 141
Jenkins Bros. ... 111
Johnson Co., C. A. ... 32, 33
Jones & Laughlin Steel Corp. ... 25, 55
Joy Mfg. Co. ... 11, 29

Kennedy-Van Saun Mfg. & Engrg. Co. ... 115
Koehring Co. ... 32, 33
Kuhn, Loeb & Co. ... 162

Laughlin, Thos., Div. American Hoist & Derrick Co. ... 168
LeTourneau-Westinghouse Co. ... 47, 48, 49
Link-Belt Co. ... 53
Longyear Co., E. J. ... 160

Mace Co. ... 190
Macwhyte Co. ... 135
Marion Power Shovel Co. ... 147
McNally Pittsburg Mfg. Corp. ... 186
Merrick Scale Mfg. Co. ... 174
Mine Safety Appliances Co. ... 169
Mine & Smelter Supply Co. ... 24

Nagle Pumps, Inc. ... 173
Naylor Pipe Co. ... 138
Newport Industries, Inc. ... 166
New York Engineering Co. ... 186
Nordberg Mfg. Co. ... 37
Northwest Engrg. Co. ... 15

Ohio Brass Co. ... 163

Page Engineering Co. ... 183
Parsons Co. ... 32, 33
Pennsylvania Drilling Co. ... 186
Pittsburgh Lectromelt Furnace Corp. ... 193
Precision Radiation Instruments, Inc. ... 165

Riblet Tramway Co. ... 176
Roebling Sons Corp., J. A. ... 125
Rollway Bearings Co., Inc. ... 185
Roots-Connersville Blower Div. Dresser Industries, Inc. ... 128
Ryerson & Sons, Inc., J. T. ... 109

Sanford Day Iron Wks. ... 60, 61
Sauerman Bros., Inc. ... 131
Searchlight Section ... 196–199
Sheffield Steel Corp. ... 188
Simplex Wire & Cable Co. ... 10
Spang & Co. ... 148
Sprague & Henwood, Inc. ... 45
Stearns Magnetic, Inc. ... 201
Stearns-Roger Mfg. Co. ... 134
Stephens-Adamson Mfg. Co. ... 65
Stratex Instrument Co., Inc. ... 180
Straub Mfg. Co., Inc. ... 172
Sturtevant Mill Co. ... 59
Superior-Lidgerwood-Mundy Corp. ... 146
Sweet's Engrg. Consultants ... 180

Taylor-Wharton Iron & Steel Co. ... 140
Tennessee Coal & Iron Div. ... 27, 129
Texas Co. ... 6, 7
Texas Gulf Sulphur Co. ... 189
Thompson Products, Ltd. ... 190
Timken Roller Bearing Co. ... Fourth Cover
Traylor Engrg. & Mfg. Co. ... 44, 120

United States Rubber Co. (Tires) ... 187
United States Rubber Co. (Mechanical Goods Div.) ... 107
United States Steel Corp. ... 27, 129
United States Steel Export Co. ... 27, 129
Universal Atomics Corp. ... 162

Victaulic Co. of America ... 154
Vulcan Iron Works Co. ... 180

Walworth Co. ... 23
Warn Mfg. Co. ... 156
Wedge-Wire Corp. ... 168
Western Machinery Co. ... 144
Wheel Trueing Tool Co. ... 123
Wickwire Spencer Steel Div. ... 58A
Wilfley & Sons Co., A. R. ... 66
Willys Motors, Inc. ... 157

Yuba Mfg. Co. ... 145

PROFESSIONAL SERVICES ... 194

SEARCHLIGHT SECTION
CLASSIFIED ADVERTISING
F. J. Eberle, Ass't. Mgr.

EMPLOYMENT OPPORTUNITIES ... 196
BUSINESS OPPORTUNITIES ... 198, 199

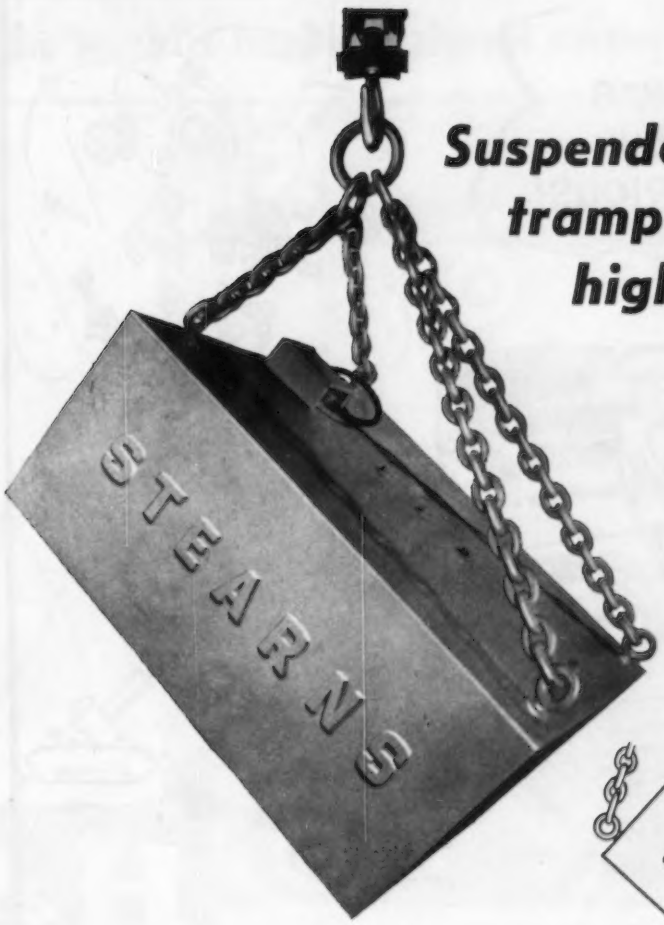
EQUIPMENT
(Used or Surplus New)
For Sale ... 198
Rail ... 198

WANTED
Equipment ... 198

ADVERTISERS INDEX

American Air Compressor Corp. ... 198
Grey River Dredging Co., Ltd. ... 198
Heineken, Inc., W. P. ... 199
Lefton Industrial Co. ... 198
Machinery Center, Inc. ... 197
Midland Mining Co. ... 198
Miller Machinery Co. ... 199
Morse Bros. Machinery Co. ... 199
O'Neill, A. J. ... 198, 199
Schoonmaker Co., A. G. ... 199
Stanhope, Inc., R. C. ... 198
Taylor-Knapp Co. ... 198
Universal Wire & Cable Co. ... 198

Suspended magnet solves tramp iron problem on high-speed conveyor handling wet or dry material



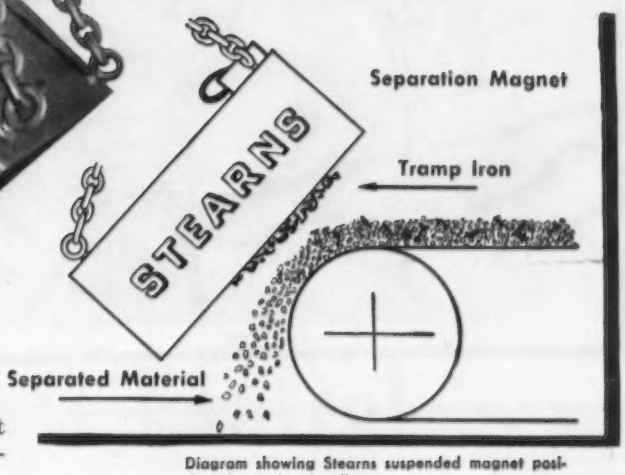


Diagram showing Stearns suspended magnet positioned over head pulley.

Stearns rectangular suspended separation magnet cures tramp iron headaches on fast-moving conveyors, particularly when material is wet.

First, the magnet's length permits its powerful, deep pulling force to work over a large area . . . dig out embedded tramp iron . . . prevent "sneak throughs." Second, the upward movement of iron to the magnet, shakes off wet, clinging material, eliminating costly waste.

Greater Flexibility

Stearns suspended magnet overcomes space limitations because it can be placed over the head pulley, or anywhere along the belt. Sometimes it's set up to remove tramp iron before material moves onto the conveyor — thus safeguarding the belt from damage. In many processing operations, Stearns suspended magnets are used ahead of magnetic pulleys to insure double protection for crushers and other expensive equipment.

Custom-Built

Magnetic specialists at Stearns design and build rectangular or circular suspended magnets, electro or permanent magnetic pulleys in standard sizes, or to your individual specifications. Get complete details from your Stearns representative or write for bulletin 25D.

Check these advantages

- All-welded, moisture-proof construction
- No moving parts that require replacing
- Single coil construction for magnetic field stability
- Leads and terminals fully protected against abrasion
- Vacuum-impregnated windings for long life, dependable operation

1115

MAGNETIC EQUIPMENT FOR ALL INDUSTRY

STEARNS MAGNETS

STEARNS MAGNETIC, INC., 624 S. 28th St., Milwaukee 46, Wis.

Spurious or non-genuine or substitute—whatever you call them they still cause profit-robbing down time. Best way to avoid it is to insist on genuine CAT* parts every time. Then you're sure of getting parts that are made to the latest design and precisely manufactured of the right materials, rigidly inspected and tested.

Take track shoes, for example

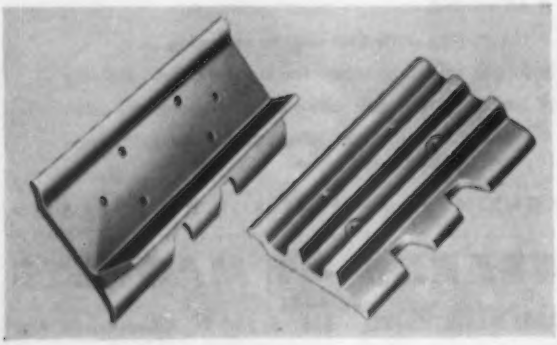
"If the shoe fits, put it on" can often be bad advice. Other makes of track shoes may *fit* all right, but how will they *wear?* It took years of research and field testing to develop Caterpillar's exclusive hardening process which makes genuine Cat shoes wear up to 75% longer than most others. The Cat shoes pictured here (a standard shoe, and a double grouser shoe for roughest rock conditions) are made of specially rolled high-quality steel sections—with a yield strength of 100,000 lb. per square inch. With a substitute track shoe: who can be sure?

The difference on the job: with genuine Caterpillar-built track shoes you can count on longer work life, less replacement, better performance under any working conditions.

With substitute parts: who can be sure?

Better get genuine Caterpillar parts every time.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.



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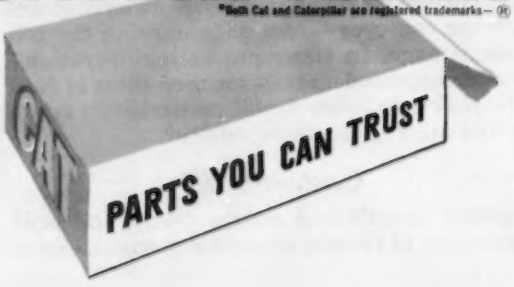
*Both Cat and Caterpillar are registered trademarks—®



For the world's happiest shovel owners and operators:

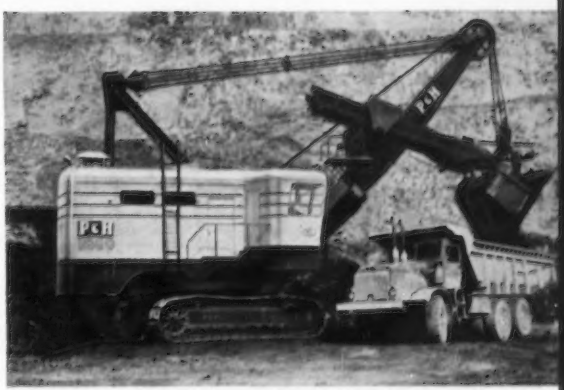
P&H

Electronic Control

Step into the new "production office" of the P&H Model Electric Shovels. Look at the control station. Can you imagine anything simpler?

What you can't imagine is the difference it makes with all operating motions electronically controlled. Response is faster, performance characteristics are improved. There's better co-ordination for the operator — and a total absence of physical effort. The new advantages made possible with complete electronic control account for up to 10% more production. And that means lower tonnage costs, of course.

P&H Electronic Control is dependable, thoroughly proved in the field. It now becomes standard on all P&H Electric Shovels — another example of the way P&H leads the field in Electric Shovel developments.



P&H Model 1800 Electric Shovel — 8 cubic yard machine

P&H ELECTRIC SHOVEL DIVISION

HARNISCHFEGER CORPORATION

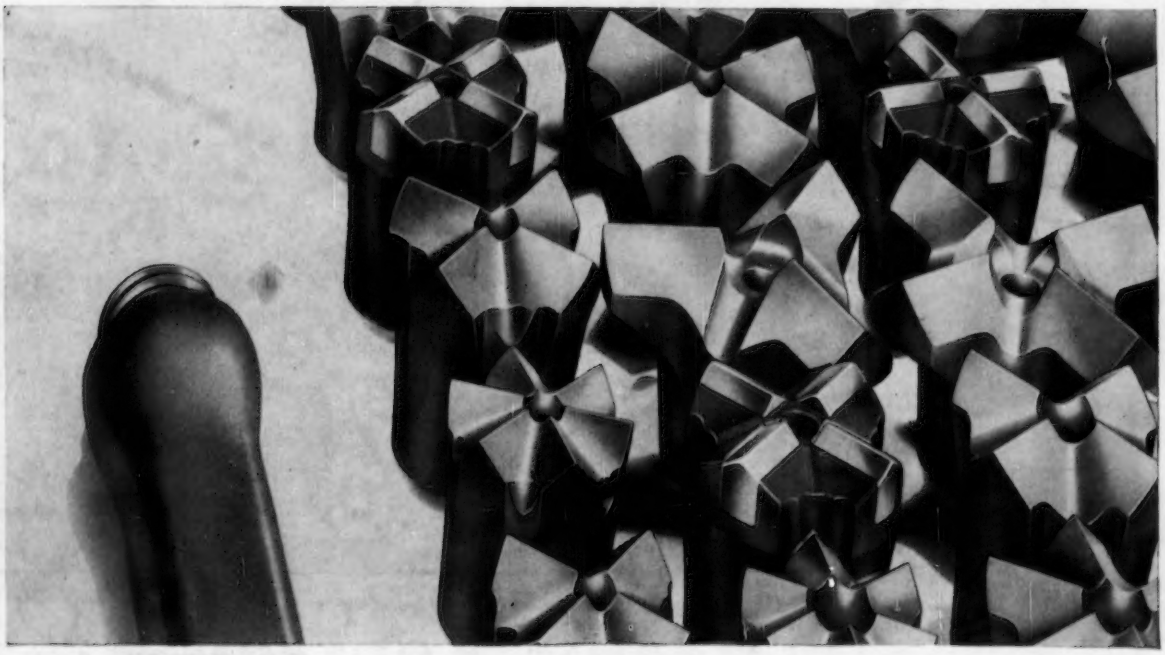
MILWAUKEE 46, WISCONSIN

the P&H *Line*

TRUCK CRANES DIESEL ENGINES POWER SHOVELS PREFABRICATE

SAVE TIME! SAVE MATERIALS! SAVE MONEY!

One drill steel does dozens of jobs when you use TIMKEN® interchangeable rock bits



Dozens of different TIMKEN® multi-use and carbide insert bits fit the same drill steel

NO need for your men to waste valuable time going after a different set of drill steels whenever they switch to a different type bit. In less than a minute, they can unscrew one type of Timken® rock bit and screw a different type on the same drill steel.

Timken rock bits make it easy for you to get the advantages of switch-bit drilling. They make it easy for your men to switch to the most economical bit as the ground changes —right on the job. And because dozens of different Timken multi-use and carbide insert bits fit the same drill steel, you'll be able to cut way down on your materials inventory.

Both Timken multi-use and carbide insert bits give you two distinct advantages: (1) they're made from electric furnace Timken alloy steel; (2) a special shoulder union keeps drilling impact from damaging threads.

If you want some help on drilling problems, call on our rock bit engineers. They're recognized experts in cutting costs, and their suggestions won't cost you a cent. Write: The Timken Roller Bearing Company, Rock Bit Division, Canton 6, Ohio. Cable address: "TIMROSCO".

HOW TIMKEN MULTI-USE BITS SAVE YOU MONEY

Most economical for ordinary ground. With correct and controlled reconditioning, they give lowest cost per foot of hole when full increments of steel can be drilled.

WHERE YOU CUT COSTS WITH TIMKEN CARBIDE INSERT BITS

Give highest speed through hard, abrasive ground. Also most economical for constant gage holes, small diameter holes, very deep holes.

... your best bet for the best bit... for every job

TIMKEN

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